PB90-186503

Technology Evaluation Report: SITE Program. CF Systems Organics Extraction System, New Bedford, Massachusetts. Volume 2

Science Applications International Corp., McLean, VA

Prepared for:

Environmental Protection Agency, Cincinnati, OH

Jan 90

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. 540/5-90/002	**2.**	**3. RECIPIENT'S ACCESSION NO.** PB90 186503/AS
4. TITLE AND SUBTITLE Technology Evaluation Report: SITE Program, CF Systems Organics Extraction System New Bedford, Massachusetts (Vol. I & II)		**5. REPORT DATE**
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Richard Valentinetti		**8. PERFORMING ORGANIZATION REPORT NO.**
9. PERFORMING ORGANIZATION NAME AND ADDRESS Science Applications International Corp. 8400 Westpark Dr. McLean, VA 22102		**10. PROGRAM ELEMENT NO.**
		11. CONTRACT/GRANT NO. 68-03-3485
12. SPONSORING AGENCY NAME AND ADDRESS Risk Reduction Engineering Laboratory Office of Research and Development U.S. EPA Cincinnati, OH 45268		**13. TYPE OF REPORT AND PERIOD COVERED** Final
		14. SPONSORING AGENCY CODE EPA/600/14

15. SUPPLEMENTARY NOTES

Steve James, (513)-569-7684 FTS:684-7684 Contact for further information.

16. ABSTRACT

This report summarizes the results of a Superfund Innovative Technology Evaluation (SITE) demonstration of the CF Systems critical fluid organics extraction system at the New Bedford Harbor, Massachusetts Superfund site. The technology depends on the ability of organic pollutants to solubilize in the process solvent, a liquefied gas. The pollutants treated include polychlorinated biphenyls (PCBs) & polynuclear aromatic hydrocarbons. The report examines the performance of the process in terms of PCB extraction efficiency, variation in process operating conditions, potential health and safety impacts, equipment and handling problems, and projected system economics. Volume I covers process design, field activities, sampling and analytical program, and results and discussion. Volume II contains sampling and analytical reports and operating log data.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT Release to Public	**19. SECURITY CLASS** *(This Report)* Unclassified	**21. NO. OF PAGES** 171
	20. SECURITY CLASS *(This page)* Unclassified	**22. PRICE** A08

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

PB90-186503

Camera-ready

EPA/540/5-90/002
January 1990

VOLUME II

TECHNOLOGY EVALUATION REPORT
CF SYSTEMS ORGANICS EXTRACTION SYSTEM
NEW BEDFORD, MASSACHUSETTS

RISK REDUCTION ENGINEERING LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

FOREWORD

The Superfund Innovative Technology Evaluation (SITE) program was authorized in the 1986 Superfund amendments. The program is a joint effort between EPA's Office of Research and Development and Office of Solid Waste and Emergency Response. The purpose of the program is to assist the development of hazardous waste treatment technologies necessary to implement new cleanup standards that require greater reliance on permanent remedies. This is accomplished through technology demonstrations that are designed to provide engineering and cost data on selected technologies.

This project consists of an analysis of CF Systems' proprietary organics extraction process. The technology demonstration took place at the New Bedford Harbor Superfund site, where harbor sediments are contaminated with polychlorinated biphenyls and other toxics. The demonstration effort was directed at obtaining information on the performance and cost of the process for use in assessments at other sites. Documentation will consist of two reports. This Technology Evaluation Report describes the field activities and laboratory results. An Applications Analysis will follow and provide an interpretation of the data and conclusions on the results and potential applicability of the technology.

Additional copies of this report may be obtained at no charge from EPA's Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268, using the EPA document number found on the front cover of the report. Once this supply is exhausted, copies can be purchased from the National Technical Information Service, Ravensworth Bldg., Springfield, VA 22161, (703) 487-4600. Reference copies will be available at EPA libraries in their Hazardous Waste Collection. You can also call the SITE Clearinghouse hotline at 1-800-424-9346 or 382-3000 in Washington, DC to inquire about the availability of other reports.

E. Timothy Oppelt, Director
Risk Reduction Engineering Laboratory

VOLUME II CONTENTS*

Page

Foreword ii
Abstract iii
Acknowledgements iv
Abbreviations and Symbols. v
C.E. Environmental: E.C. Jordan Corp. Analysis Report 1
Radian Corporation Analysis Report 73
Operating Log Data 146

*Volume I contains introduction, descriptions of process design, field activities, and sampling and analytical program, and results and discussion.

ABSTRACT

The SITE Program demonstration of CF Systems' organics extraction technology was conducted to obtain specific operating and cost information that could be used in evaluating the potential applicability of the technology to Superfund sites. The demonstration was conducted concurrently with pilot dredging studies managed by the U.S. Army Corps of Engineers at the New Bedford Harbor Superfund site in Massachusetts. Contaminated sediments were treated by CF Systems' Pit Cleanup Unit (PCU) that used liquefied propane/butane as the extraction solvent. The PCU was a trailer-mounted system with a design capacity of 1.5 gpm (20 bbl/day). CF Systems claimed that the PCU would extract organics from contaminated soils based on solubility of organics in liquefied propane/butane.

The objectives included an evaluation of (1) the unit's performance, (2) system operating conditions, (3) health and safety considerations, and (4) equipment and system materials handling problems. Extensive sampling and analyses were performed showing that polychlorinated biphenyl (PCB) extraction efficiencies of 90 percent were achieved for sediments containing PCBs ranging from 350 to 2,575 ppm. In Test 2, sediments containing 350 ppm were reduced to 40 ppm after 10 passes, or recycles, through the PCU. In Test 3, a 288 ppm feed was reduced to 82 ppm after 3 passes. In Test 4, a 2,575 ppm feed was reduced to 200 ppm after 6 passes. Some operating problems occurred, such as the intermittant retention of solids in system hardware and foaming in the treated sediment collection tanks. These problems did not affect extraction efficiency but could affect operation of a full-scale unit. Corrective measures will be addressed by the developer and EPA. A mass balance established over the entire demonstration showed excellent accountability for 96 percent of the total mass. Operation of the unit did not present any threats to the health and safety of operators or the local community.

ACKNOWLEDGMENTS

This report was prepared under the direction and coordination of Richard Valentinetti, EPA SITE Program Manager in the Risk Reduction Engineering Laboratory, Cincinnati, Ohio. Contributors and reviewers for this report were Frank Ciavattieri of EPA Region I, Remedial Project Manager for the New Bedford Harbor Superfund site; Jim Cummings and Linda Galer from the Office of Solid Waste and Emergency Response; Paul Desrosiers, Diana Guzman, Paul de Percin, and Laurel Staley from the Office of Research and Development; Christopher Shallice and Thomas Cody, Jr. from CF Systems Corporation. Logistics at the site was coordinated by Mark Otis, U.S. Army Corps of Engineers; and Alan Fowler and Siegfried Stockinger of EBASCO Services, Inc.

This report was prepared for EPA's Superfund Innovative Technology Evaluation (SITE) Program by Science Applications International Corporation (SAIC), McLean, VA for the U.S. Environmental Protection Agency under Contract No. 68-03-3485, by Don Davidson, Richard Hergenroeder, Kim Gotwals, Jorge McPherson and Fernando Padilla. Laboratory analyses were conducted by E.C. Jordan, Inc., Portland, ME, and Radian Corporation, Austin, TX.

ABBREVIATIONS AND SYMBOLS

amps	amperes
ASTM	American Society for Testing and Materials
bbl/day	barrels per day
BNAs	base/neutral and acid extractable compounds
Cd	cadmium
COE	U.S. Army Corps of Engineers
cP	centipoise
Cr	chromium
CR	column reboiler
Cu	copper
CWA	Clean Water Act
dPa.s	decapascal.seconds
ECD	electron capture detector
EPA	Environmental Protection Agency
EPT	extract product tank
EP Tox	Extraction Procedure Toxicity Test - leach test
F	Fahrenheit
FK	feed kettle
g	grams
GC	gas chromotography
gpd	gallons per day
gpm	gallons per minute
kw-hr	kilowatt hours
lbs	pounds
lb/gal	pounds per gallon
lb/min	pounds per minute
max	maximum
MBAS	methylene blue active substances
mg	milligrams
mg/kg	milligrams per kilogram
min	minimum
ms	mass spectrometry
MSA	method of standard additions
MS/MSD	matrix spike/matrix spike duplicate

ND	not detected
NIOSH	National Institute of Occupational Safety and Health
NR	not reported
ORD	Office of Research and Development
OSWER	Office of Solid Waste and Emergency Response
OVA	organic vapor analyzer
oz	ounces
PAHs	polyaromatic hydrocarbons
Pb	lead
PCBs	polychlorinated biphenyls
PCU	Pit Cleanup Unit
ppm	parts per million
psig	pounds per square inch gauge
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
RPD	relative percent difference
RREL	Risk Reduction Engineering Laboratory
RSD	relative standard deviation
SARA	Superfund Amendments and Reauthorization Act of 1986
SBT	still bottoms tank
SITE	Superfund Innovative Technology Evaluation Program
SRC	solvent recovery column
TDS	total dissolved solids
TS	total solids
TSS	total suspended solids
VAC	volts, alternating current
VOAs	volatile organic analytes
Zn	zinc
<	less than

SUPERFUND INNOVATIVE TECHNOLOGY
EVALUATION (SITE) PROGRAM
CF SYSTEMS CORPORATION PROCESS EVALUATION

Final Report

Prepared for:

SAIC
(Science Applications International Corporation)

by:

C-E Environmental: E.C. Jordan Co.

MAY 1989

EPA Contract No. 68-03-3485, No. 0-9
SAIC Project No. 1-830-07-781-00

TABLE OF CONTENTS

Section	Title	Page No.
1.0	BACKGROUND	4
1.1	PROJECT BACKGROUND	4
1.2	DEVELOPER TECHNOLOGY AND CLAIMS	4
1.3	LABORATORY EVALUATION	4
1.4	PREPARATION OF QUALITY ASSURANCE PLAN	4
1.5	CRITICAL OBJECTIVES	6
1.6	OTHER OBJECTIVES	6
2.0	SAMPLING	6
2.1	SAMPLING PERSONNEL	6
2.2	SAMPLE RECEIPT AND CUSTODY	6
2.3	SAMPLE IDENTIFICATION KEY	6
3.0	ANALYTICAL METHODS	7
3.1	PCB ANALYSIS	7
3.1.1	Spittle Screen (Gas Chromatography)	7
3.1.2	USEPA Method 8080 (Gas Chromatography)	7
3.1.3	USEPA 680 (GC/MS)	7
3.2	OTHER ANALYSES	8
4.0	DISCUSSION OF ANALYSIS BY PHASE	8
4.1	BENCH SCALE TEST 1	8
4.2	BENCH SCALE TEST 2	9
4.3	BENCH SCALE TEST 3	9
4.4	DRUM ANALYSES (PRE-DEMONSTRATION)	9
4.5	DEMONSTRATION TEST 1	10
4.6	DEMONSTRATION TEST 2	10
4.7	DEMONSTRATION STUDY 3	11
4.8	DEMONSTRATION STUDY 4	11
4.9	DEMONSTRATION STUDY 5	12
4.10	SITE CHARACTERIZATION	12
4.11	CLEAN-UP PHASE	12

REFERENCES

APPENDICES

APPENDIX A - METHODS OF ANALYSIS
APPENDIX B - POLYCHLORINATED BIPHENYL (PCB) RESULTS BY PHASE
APPENDIX C - TOTAL RESIDUE PCB, OIL AND GREASE, pH, CYANIDE, TOTAL SUSPENDED SOLIDS, TOTAL DISSOLVED SOLIDS AND METHYLENE BLUE ACTIVE SUBSTANCES RESULTS

TABLE OF CONTENTS
(continued)

Section Title

APPENDIX D - ELEMENTAL RESULTS OF ANALYSIS

SEMIVOLATILE ORGANICS RESULTS OF ANALYSIS
PARTICLE SIZE ORGANICS RESULTS OF ANALYSIS
*APPENDIX E - RAW DATA
PCB RAW DATA
VOLATILE ORGANICS RAW DATA
SEMIVOLATILE RAW DATA
ELEMENTS RAW DATA
WET CHEMISTRY RAW DATA
*APPENDIX F - TECHNICAL SYSTEMS REVIEW
*APPENDIX G - VISUAL SAMPLE DESCRIPTIONS

---

*Appendices E, F, and G are not included in Volume II of the Technical Evaluation Report because of their size.

1.0 BACKGROUND

1.1 Project Background

The U.S. Environmental Protection Agency has established a program to accelerate the development of new and innovative technologies to address hazardous waste problems. This program is known as the Superfund Innovative Technology Evaluation (SITE) Program. The site selected for demonstration of this technology was New Bedford Harbor in New Bedford, Massachusetts. This site is ranked Number 80 on the National Priority List and covers over 1,800 acres. The site is contaminated primarily with polychlorinated biphenyls (PCBs) and several heavy metals (copper, chromium, lead, and zinc). PCB contamination ranges from a few ppm to over 30,000 ppm. A flow chart listing the key parties involved in this project and their responsibilities is provided in Figure 1-1.

1.2 Developer Technology and Claims

Technology developed by the CF Systems Corporation of Waltham, MA uses propane, liquefied under pressure, to selectively extract complex organics from slurried sediments or sludges. The developer claims that the treatment unit can extract over 90 percent of the organics from the waste matrix.

1.3 Laboratory Evaluation

All laboratories involved with SITE projects are subject to pre-program as well as a Technical Systems Review (TSR) during the course of specific projects. This includes providing results of the Water Pollution Studies (WP) administered by USEPA's Environmental Monitoring Support Laboratory (EMSL) in Cincinnati to the SAIC Quality Assurance Officer.

The C-E Environmental Laboratory was initially evaluated by an audit team of SAIC and RTI personnel prior to actual project assignment (RTI served as RREL subcontractor). The general laboratory review determined that project specific QA/QC requirements could be implemented. A copy of the draft review summary from RTI is found in Appendix F. A technical Systems Review (TSR) was conducted after project inception by S-Cubed personnel for RREL. As identified in the project specific QAPP, Aroclor and polychlorinated biphenyls (PCBs) were the only critical measurements for the project. The TSR determined several critical concerns existed. However, those specific critical analytical and project QA/QC requirements identified initially were corrected as noted in the follow up TSR from S-Cubed. The corrections resulted in a satisfactory rating. Copies of the TSR reports and correspondence appear in Appendix F.

1.4 Preparation of Quality Assurance Plan

As part of the overall Quality Assurance Program Plan (QAPP) a project specific analytical QAPP was developed. This project-specific QAPP was developed in accordance with the requirements for Category II RREL projects and incorporated into the overall QAPP. Analytical data generated for the demonstration project were to be used to quantify CF Systems' claims of PCB removal. Accordingly, the only critical parameter identified in the analytical QAPP, Method 8080 from SW-846, Test Methods for Evaluating Solid Waste, 3rd edition was the analytical

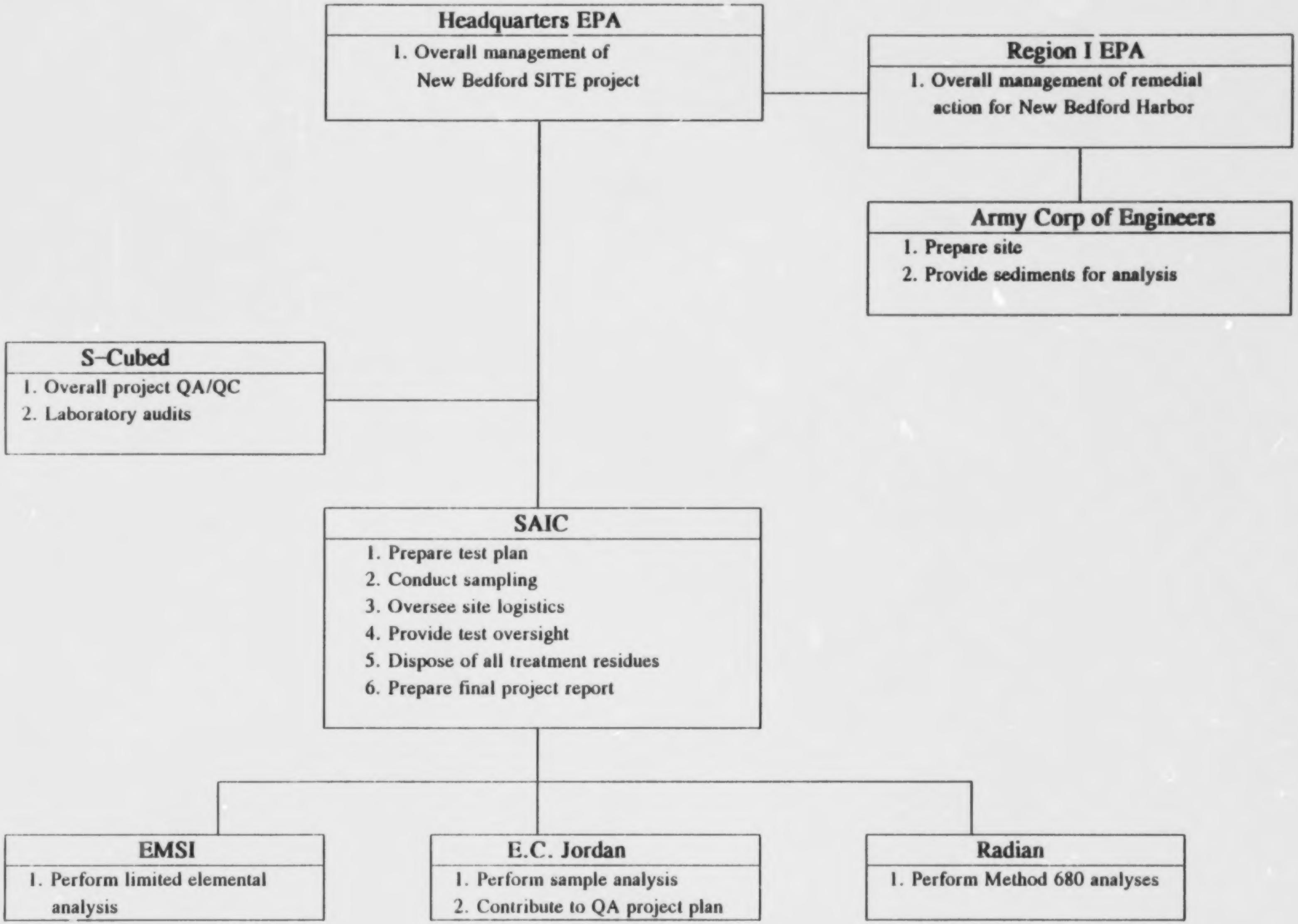

Headquarters EPA
1. Overall management of New Bedford SITE project
Region I EPA
1. Overall management of remedial action for New Bedford Harbor
Army Corp of Engineers
1. Prepare site
2. Provide sediments for analysis
S-Cubed
1. Overall project QA/QC
2. Laboratory audits
SAIC
1. Prepare test plan
2. Conduct sampling
3. Oversee site logistics
4. Provide test oversight
5. Dispose of all treatment residues
6. Prepare final project report
EMSI
1. Perform limited elemental analysis
E.C. Jordan
1. Perform sample analysis
2. Contribute to QA project plan
Radian
1. Perform Method 680 analyses

Figure 1-1. Key Parties Involved in the New Bedford Harbor SITE Demonstration.

protocol chosen to evaluate the developer's claims. Other analyses were intended for process control and/or ultimate disposal of project residue and were not critical measurements for the project.

1.5 Critical Objectives

The primary objective is to test CF Systems treatment claim for PCB removal from New Bedford Harbor sediments. The secondary objective is to determine the chemical composition of treatment system residues.

1.6 Other Objectives

Other parameters of interest are present at significant concentration in New Bedford Harbor sediments. These parameters include polyaromatic hydrocarbons (PAHs), cadmium, chromium, copper, zinc and lead. Analysis of New Bedford Harbor sediments for these parameters is an additional objective of this study.

2.0 SAMPLING

2.1 Sampling Personnel

CF Systems conducted the sampling for Bench Tests 1, 2 and 3. SAIC conducted the sampling for the remainder of the project. Samples were delivered to E.C. Jordan or shipped via overnight courier.

2.2 Sample Receipt and Custody

Samples were received by E.C. Jordan personnel in accordance with the sample receipt and custody procedures as outlined in the Quality Assurance Project Plan, Revision No. 2, Section 4.3.4, Reference No. 1.

2.3 Sample Identification Key

Sample name abbreviations were adopted by SAIC and these abbreviations were employed throughout the entire project (sampling through reporting). These abbreviated sample names can be traced, along with their corresponding E.C Jordan Laboratory Numbers, back to the original chain-of-custody. The abbreviations described here do not apply to the Bench Scale Phases which were sampled by C.F System's personnel. Descriptions of the sample points can be found in the Quality Assurance Project Plan.

Abbreviation	Full Name
FK	Feed Kettle
RPT	Raffinate Product Tank
EPT	Extract Product Tank
S-1	Basket Strainer
F-1	Multi-Mode Filter
F-2	Cartridge Filter
CC	Carbon Canister
R	Replicate
LOC	Location

Sediment drum samples were given identifications by SAIC. Three replicate samples were taken from each drum and can be identified by the last digit in the sample name.

3.0 ANALYTICAL METHODS

3.1 PCB Analysis

Three different methods of PCB analysis of sediments were utilized.

- Spittler Method (3)(4)
- USEPA Method 3550/8080 (2)
- USEPA Method 680 (5)

3.1.1 Spittler Screen (Gas Chromatography). The Spittler Screen was utilized to identify the approximate level of PCBs in a sample to aid analysts in choosing dilution factors and provide a rapid analytical turnaround for large volumes of samples to optimize those subject to further analyses. This screening procedure was not used for any critical measurements. The advantage to the screen method is that the linear calibration range is expanded to 0-500 mg/kg. This reduces the number of dilutions necessary to attain the dynamic range of the GC. Less sample (2g) is required for extraction, and results are generally possible within 24 to 48 hours of sample submittal. The results of the screen method will be utilized to determine the exact range. This in turn will reduce the number of dilutions and potential error.

3.1.2 USEPA Method 8080 (Gas Chromatography). The critical analytical method is the measurement of PCBs. Analytical data generated by this demonstration project will be utilized to quantify the developer's claims of PCB removal by the technology. Generation of valid, defensible data is critical for evaluation of Comprehensive Environmental Response Compensation and Liability Act/Superfund Amendments Reauthorization Act (CERCLA/SARA) technologies, mandating the use of standard, approved analytical methods. Accordingly, USEPA method 8080 was used throughout the demonstration project for PCB. This method is capable of quantifying PCB to about 160 μg/Kg in sediments and will adequately quantify the level of PCB remaining in the treated soils.

3.1.3 USEPA Method 680 (GC/MS). Method 8080 utilizes identification and quantitation by the recognition of arochlors. Aroclors are standard mixes of individual PCBs or congeners. Several manufacturers have produced commercial PCBs; however, Aroclor, a Monsanto tradename, is the type found in New Bedford Harbor sediments. Method 680 employes a gas chromatograph/mass spectrometer to determine individual congeners. This analysis can be accomplished whether the PCBs are in the form of Aroclor mixes or as individual congeners.

If fractionation or selective extraction of Aroclors had occurred to the extent that quantitative analysis by method 8080 was deemed inadequate, method 680 was to be employed. After discussion and several split sample analyses between Radian and E.C. Jordan, it was determined that fractionation and selective extraction was not significant. This decision was made by James R. Payne, Ph.D. (SITE Program QA Manager). This decision was documented in the 9 November 1988 letter from Dr. Payne to Dr. Davidson (SAIC).

3.2 Other Analyses

A table listing all other analyses and the methods used can be found in Appendix A.

4.0 DISCUSSION OF ANALYSIS BY PHASE

A tabulated summary of PCB results of analysis by project phase can be found in Appendix B. A summary of PCB, total solids, oil and grease, pH, total dissolved solids, total suspended solids, MBAS, and cyanide results of analysis can be found in Appendix C. Elemental, volatile organics, semivolatile organics and particle size results of analyses can be found in Appendix D. All raw data can be found in Appendix E. Bench Scale Tests 1, 2 and 3 were conducted by CF Systems as a pre-demonstration test of similar materials on a smaller bench scale magnitude. The drum analyses were conducted to characterize the New Bedford harbor sediment which was the starting material for all of the following demonstration tests. Demonstration Tests 1 through 5 were actual tests of CF System's full scale unit at New Bedford Harbor utilizing the sediments from the previous drum study. Site characterization was accomplished by sampling soil samples at the New Bedford Harbor demonstration site before and after the demonstration tests. The Clean-up Phase consisted of washing CF Systems unit with toluene. This toluene was later tested for PCBs.

4.1 Bench Scale Test 1

A total of 24 samples were received June 3 and 4, 1988. Sample matrices included both sediment and oil, and the analyses consisted of PCBs only.

During Bench Scale I, limitations to method SW846 8080 were discovered. The amount of sample collected for extraction and analysis was inadequate for both the soil and oil extract fractions. The levels of PCBs found also presented some problems due to the large dilutions required to bring the analysis into the working calibration ranges for method 8080. The dilutions caused two problems. The first problem was the loss of Aroclor 1254 information caused by performing sufficient dilutions to quantitate Aroclor 1242. The second problem was the higher uncertainty associated with each analytical result due to the additive error of serial diluting. The oil extracts were received in 40 ml VOA vials as thin films of residue dried on the sides of the vials. To recover the extract required that the vials be preweighed before adding hexane. The vials were vortexed with a known amount of hexane and then decanted for acid washing. The VOA vials were then air dried and reweighed. The amount of oil was then calculated by difference and in some cases was in the low milligram range. When these low milligram masses are multiplied through the serial dilution, the margin of error increases for the final analytical result.

All of the samples run during Bench Scale I contained Aroclor 1242 with a smaller percentage of Aroclor 1254. There was also some question as to the presence of Aroclor 1248, which elutes between the two other Aroclors. A megabore DB 608 column was used to enhance information pertaining to pattern recognition of the Aroclors present in the sample. This information was needed to determine if selective removal of PCB congeners was taking place.

After completion of Bench Scale I, a meeting between representatives from SAIC, CF Systems, and E.C. Jordan was held to discuss the limitations of the method, sample amounts, and turnaround required for the Bench Scale analysis. The Spittler PCB Screening method was accepted as the method of choice for the second and third bench scale tests which were to follow. Method 8080 was chosen for the following Demonstration Tests (critical objective).

4.2 Bench Scale Test 2

A total of 15 samples were received for Bench Test 2. The sample receipt schedule is as follows:

Number of Samples	Date Received
2	7 July 1988
2	15 July 1988
1	18 July 1988
1	19 July 1988
2	20 July 1988
1	21 July 1988
2	22 July 1988
4	11 August 1988

All sample matrices were sediments. Analyses performed on all or a portion of the samples were PCBs, oil and grease, and total solids.

4.3 Bench Scale Test 3

A total of 12 samples were received for Bench Test 3. Four were received on 4 September 1988 and eight were received on 13 September 1988. These samples were analyzed for PCBs, total solids, and on a portion of the samples, oil and grease. The sample matrices were sediment and oil.

4.4 Drum Analyses (Pre-demonstration)

New Bedford Harbor sediment, which was the demonstration project starting material, was collected in drums. Twenty-nine samples were sent to the laboratory for analysis. Nine samples were received on 18 August 1988 and the remaining 20 were received on 23 August 1988. The analyses performed on these samples were total solids, PCBs, oil and grease, cyanide, EP toxicity metals, pH, semivolatile organics and volatile organics. PCB results ranged from 100 ppm dry weight to 58,000 ppm dry weight.

4.5 Demonstration Test 1

A total of three samples (two sediments and one oil matrix) were received on 7 September 1988. The laboratory was instructed to expect similar total solids in the Demonstration Study as was in the Bench Study (20 to 70 percent). E.C. Jordan sample 8251001 (RPT-1) contained 1.6 percent solids. SAIC made the decision to treat the sample as a solid by adding sodium sulfate and extracting using method 3050[2]. Analyses included in all or a portion of the samples were PCBs (method 8080) and total solids.

Analytical work on Demonstration 1 had just begun when an audit was held at E.C. Jordan by USEPA and S-Cubed see Appendix F. Some problems were identified by the audit team and work was placed on hold until the areas of concern were addressed. Several changes were immediately implemented to the laboratory procedures. Surrogate 2,4,5-6-tetrachloro-meta-xylene (TCMX) was added to replace di-b-butylchlorendate (DBC) which coeluted with Aroclor 1254. Independent check standards were run after each calibration to confirm the validity of the calibration. Hexane was replaced with iso-octane as the solvent for PCB standard preparation. Aroclor 1242 was chosen as the spiking compound for matrix spikes since it was the primary Aroclor in the samples. Since E.C. Jordan was charged with following method 8080, no acid washes were employed as a method for sample clean-up. Jim Payne, Ph.D (SAIC) advised E.C. Jordan, in a letter dated 28 September 1988, to modify method 8080 by the addition of the acid wash technique. All samples which were extracted to this point were re-extracted using all the suggestions made by Dr. Payne and the S-Cubed audit team. Demonstration 1 samples were highly contaminated with hydrocarbons.

4.6 Demonstration Test 2

Thirty-two samples were received on the following dates:

Number of Samples	Date Received	Matrix
1	9 September 1988	Sediment
2	12 September 1988	Sediment
4	13 September 1988	Sediment/Oil/Water
4	14 September 1988	Sediment
3	15 September 1988	Sediment
6	16 September 1988	Sediment
10	19 September 1988	Sediment/Oil
2	26 September 1988	Gasoline

The analyses performed on these samples were total solids, PCBs, oil and grease, pH, total suspended solids, total dissolved solids, methylene blue active substances, semivolatile organics and elements. Not all samples were analyzed for all parameters. Demonstration 2 samples were highly contaminated with hydrocarbons.

4.7 Demonstration Study 3

Twenty-four samples were received as the following schedule indicates:

Number of Samples	Date Received	Matrix
6	19 September 1988	Sediment
5	20 September 1988	Sediment
7	21 September 1988	Sediment/Oil
6	26 September 1988	Oil

The analyses performed on these samples were: PCBs, total solids, elements, oil and grease, and pH. Not all samples were analyzed for all parameters.

Unlike Demonstration 1 and 2, Demonstration 3 samples contained lower levels of hydrocarbons. PCB chromatograms had significantly reduced levels of hydrocarbon baseline shifts.

4.8 Demonstration Study 4

Thirty-four samples were received as indicated in the following schedule:

Number of Samples	Date Received	Matrix
7	21 September 1988	Sediment
2	22 September 1988	Sediment
2	23 September 1988	Sediment
10	27 September 1988	Oil/Sediment
5	29 September 1988	Sediment/Oil
5	30 September 1988	Sediment/Oil
2	1 October 1988	Sediment
1	24 October 1988	(Extract from Radian Corp.)

These samples were similar to Demonstration 3 with regards to hydrocarbon contamination. One sample, E.C. Jordan no. 8265064, had analysis placed on hold by SAIC. The analysis for this sample was cancelled at a later date.

Three samples, E.C. Jordan no. 8273004, 8273005, 8273003, were sent to Radian Corporation for analysis. Final results of analysis were never transmitted to E.C. Jordan Co. by Radian Corporation.

Demonstration 4 samples were analyzed for PCBs, total solids, oil and grease, pH, elements, and semivolatile organics. Not all samples were analyzed for all parameters.

4.9 Demonstration Study 5

Three oil matrix samples were received on 1 October 1988. These samples were analyzed for PCBs only. This was the last of the demonstration studies. No PCBs were found in these samples (detection limit 200 ppm wet weight).

4.10 Site Characterization

Twenty-one samples were received for this study. Soil samples were taken at varoius locations on the work site adjacent to New Bedford Harbor. Ten samples were taken before Demonstration Study 1 to determine initial site contamination. These samples were received on 12 August 1988. Eleven soil samples were taken after Demonstration Study 5 to determine if additional site contamination occurred. These samples were receibed on 7 October 1988. Total solids and PCBs were the only analyses performed on these samples.

4.11 Clean-up Phase

After Demonstration Study 5, the CF System's demonstration equipment was rinsed with toluene. Sixteen samples of the toluene rinsate were received on 5 October 1988. The samples were analyzed for PCBs only.

REFERENCES

1. SAIC; Liquified Gas Extraction of Polychlorinated Biphenyls Quality Assurance Project Plan, 26 August 1988.

2. USEPA-SW-846; Test Methods for Evaluating Solid Waste, Third Edition, November 1986.

3. Fowler, Bruce A. and Bennett, Joseph T.; Screening for Characterization of PCB-containing Soils and Sediments, Proceedings of the National Conference on Hazardous Wastes and Hazardous Materials, March 1987.

4. Spittler, T.M.; Field Measurement of Polychlorinated Biphenyls in Soil and Sediment Using a Portable Gas Chromatograph, Environmental Sampling for Hazardous Wastes, American Chemical Society, 1984.

5. USEPA; Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Mass Spectrometry, November 1985.

6. USEPA-600/4-79-020; Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

7. ASTM; Standard Method for Sieve Analysis of Fine and Coarse Aggregates, December 1984.

APPENDIX A

Parameter	Matrix	Method
PCBs	Sediment	3550[2]/8080[2]/Spittler[3,4] (see Section 3.1)
PCBs	Water	3510[2]/8080[2]
PCBs	Oil	3580[2]/8080[2]
Elements	Sediment	3050[2]/6010[2]
Elements	Oil	3040[2]/=> Cd→7130, Cu→7210, Zn→7950 Cr→7190, Pb→7420
EP Toxicity (Elements)	Soils/Sediments	1310[2]/3010[2]/6010[2]→Ba, Cd, Cr, Se, Ag, Pb (only); 7060→As, 7470→Hg, 7421→Pb, 7740→Se
Volatile Organics	Sediment	8240[2]
Semivolatile Organics	Sediment	8270[2]
Semivolatile Organics	Oil	Dissolution/8270[2]
Cyanide	Sediment	CLP-M 335.2 (CLP-CIP SOW No. 787)
Oil and Grease	Sediment	9071[2] (SW846 Gravimetric, Solvent Extraction)
pH	Sediment	9045[2] (SW846 Electrometric)
Total Solids	Sediment	1310[2]
Particle Size	Sediment	ASTM-C-13684a[7]
Non-filterable Residue	Water	160.2[6] Gravimetric 103-1050C
Filterable Residue	Water	160.1[6] Gravimetric 180oC
Methylene Blue Substances	Water	425.1[6] Colorimetric, Solvent Extraction

Appendix B

Polychlorinated Biphenyl (PCB) Results of Analysis by Phase

TABLE 1
BENCH 1 STUDY
PCB Results by Method 8080 (1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm wet wt.)
03-Jun-88	8155054	F-1	55
03-Jun-88	8155055	F-2	42
03-Jun-88	8155056	F-3	38
03-Jun-88	8155057	F-4	1900
03-Jun-88	8155058	F-5	1100
03-Jun-88	8155059	F-6	1700
03-Jun-88	8155060	W-1	10
03-Jun-88	8155061	W-2	0.52

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

TABLE 2
BENCH 1 STUDY
PCB Results by Method 8080 (1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm wet wt.)
04-Jun-88	8156001	E1-1A	18000
04-Jun-88	8156002	E1-1B	20000
04-Jun-88	8156003	E1-1C	< 530
04-Jun-88	8156004	E1-1D	< 2000
04-Jun-88	8156005	E1-1E	15000
04-Jun-88	8156006	E1-1F	15000
04-Jun-88	8156007	E1-1G	16000
04-Jun-88	8156008	E2-2A	240000
04-Jun-88	8156009	E2-2B	180000
04-Jun-88	8156010	E2-2C	140000
04-Jun-88	8156011	E2-2D	*
04-Jun-88	8156012	E2-2E	16000
04-Jun-88	8156013	E2-2F	170000
04-Jun-88	8156014	E2-2G	29000
04-Jun-88	8156015	E2-2H	45000
04-Jun-88	8156016	E2-2I	78000

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

* Sample lost due to vial breakage.

TABLE 1
BENCH 2 STUDY
PCB Results by Spittler Method(1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.)
05-Jul-88	8189022	Feed J-13-2	220
05-Jul-88	8189021	Feed WQL 3309	3400
15-Jul-88	8197004	Sludge 1	6200
15-Jul-88	8197005	Sludge 2	4600
18-Jul-88	8200001	Sludge 3	3800
19-Jul-88	8201007	Sludge 4	3300
19-Jul-88	8201008	Sludge 5	3400
20-Jul-88	8202007	Sludge 6	210
20-Jul-88	8202008	Sludge 7	170
21-Jul-88	8203035	Sludge 8	23
22-Jul-88	8204016	Sludge 9	68
22-Jul-88	8204017	Sludge 10	54
11-Aug-88	8224020	Sludge 11	5300
11-Aug-88	8224021	Sludge 12	4000
11-Aug-88	8224022	Sludge 13	1600
11-Aug-88	8224023	Sludge 14	430

(1) Fowler,B.A. and Bennet,J.T., "Screening for Characterization of PCB-Containing Soils and Sediments" E.C. Jordan Co. 1987

TABLE 2
BENCH 2 STUDY
PCB Results by Oil Method(1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.)
19-Jul-88	8201009	Oil 1	70000
19-Jul-88	8201010	Oil 2	280000
19-Jul-88	8201011	Oil 3	170000
19-Jul-88	8201012	Oil 4	390000
19-Jul-88	8201013	Oil 5	47000
19-Jul-88	8201014	Oil 6	390000
19-Jul-88	8201015	Oil 7	260000
19-Jul-88	8201016	Oil 8	160000
19-Jul-88	8201017	Oil 9	50000
25-Jul-88	8207001	Oil 10	19000
25-Jul-88	8207002	Oil 11	7700
25-Jul-88	8207003	Oil 12	37000
25-Jul-88	8207004	Oil 13	38000
25-Jul-88	8207005	Oil 14	46000
25-Jul-88	8207006	Oil 15	27000
22-Jul-88	8204018	Oil 16	6600
22-Jul-88	8204019	Oil 17	2400
22-Jul-88	8204020	Oil 18	1300
22-Jul-88	8204021	Oil 19	850
11-Aug-88	8224017	Oil 20	81000
11-Aug-88	8224018	Oil 21	660000
11-Aug-88	8224019	Oil 22	350000

(1) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

BENCH 3 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB(ppm dryweight) Spittler(1)/Oil(2) Method	PCB(ppm dry weight) Method 8080(3)
02-Sep-88	8246001	Sludge 15	210	QNS
02-Sep-88	8246002	Sludge 16	340	QNS
02-Sep-88	8246003	Sludge 17	57	QNS
02-Sep-88	8246004	Sludge 18	17	QNS
13-Sep-88	8257019	Sludge 19	11000	QNS
13-Sep-88	8257020	Sludge 20	5800	QNS
13-Sep-88	8257021	Sludge 21	940	QNS
13-Sep-88	8257022	Sludge 22	220	QNS
02-Sep-88	8246005-6	Oil 23A,B *	33000	QNS
02-Sep-88	8246007-10	Oil 24A,B,C,D *	67000	QNS
13-Sep-88	8257026	Oil 25	54000	QNS
13-Sep-88	8257023	Oil 26	13000	QNS
13-Sep-88	8257024	Oil 27	150000	QNS
13-Sep-88	8257025	Oil 28	140000	QNS

QNS - Quantity not sufficient.

* - These samples were composited.

(1) Fowler,B.A and Bennett,J.T., "Screening for Characterization of PCB-Containing Soils and Sediments" E.C. Jordan Co. 1987

(2) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

(3) U.S. EPA-SW846, "Method 8080-Organochlorine Pesticides and PCBs," 3rd Ed., U.S. EPA. Washington, D.C., 1986

Table 1
DRUM STUDY
PCB Results by Method 8080 (1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry weight)
18-Aug-88	8231011	L-7-1	360
18-Aug-88	8231012	L-7-2	312
18-Aug-88	8231013	L-7-3	640
18-Aug-88	8231014	J-7-1	13600
18-Aug-88	8231015	J-7-2	50000
18-Aug-88	8231016	J-7-3	57900
18-Aug-88	8231017	H-22-1	530
18-Aug-88	8231018	H-22-2	460
18-Aug-88	8231019	H-22-3	930

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

Table 2
DRUM STUDY
PCB Results by Method 8080 (1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry weight)
23-Aug-88	8236007	I-11-1	32000
23-Aug-88	8236008	I-11-2	27800
23-Aug-88	8236009	I-11-3	37300
23-Aug-88	8236010	L-9-1	2910
23-Aug-88	8236011	L-9-2	3100
23-Aug-88	8236012	L-9-3	4100
23-Aug-88	8236013	H-21-1	360
23-Aug-88	8236014	H-21-2	290
23-Aug-88	8236015	H-21-3	350
23-Aug-88	8236016	H-20-1	470
23-Aug-88	8236017	H-20-2	295
23-Aug-88	8236018	H-20-3	450
23-Aug-88	8236019	L-8-1	330
23-Aug-88	8236020	L-8-2	300
23-Aug-88	8236021	L-8-3	270
23-Aug-88	8236022	H-23-1	100
23-Aug-88	8236023	H-23-2	234
23-Aug-88	8236024	H-23-3	150
23-Aug-88	8236025	Composite 1	8800
23-Aug-88	8236026	Composite 1R	990

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

DEMONSTRATION 1 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Spittler (1)/Oil (2)	PCB (ppm dry wt.) Method 8080 (3)
07-Sep-88	8251002	FK-1	340	360
07-Sep-88	8251001	RPT-1	560	< 840
07-Sep-88	8251003	EPT-1	< 5	< 200

(1) Fowler,B.A and Bennett,J.T., "Screening for Characterization of PCB-Containing Soils and Sediments" E.C. Jordan Co. 1987

(2) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

(3) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

TABLE 1
DEMONSTRATION 2 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Method 8080 (1)
09-Sep-88	8253002	FK-1 Pass 1	350
13-Sep-88	8257029	Resi Feed Low Pass 2	218
12-Sep-88	8256003	RPT-1 Pass 1	77
14-Sep-88	8258029	RPT-1 Pass 2	52
15-Sep-88	8259022	RPT-1 Pass 3	10.1
15-Sep-88	8259023	FK-1 Pass 4	30
16-Sep-88	8260004	RPT-1 Pass 4	66
16-Sep-88	8260005	RPT-1 Pass 5	59
16-Sep-88	8260008	RPT-1 Pass 6	41
19-Sep-88	8263010	RPT-1 Pass 7	36
19-Sep-88	8263011	RPT-1 Pass 8	29
19-Sep-88	8263012	RPT-1 Pass 9	7.8
19-Sep-88	8263015	FK-1 Pass 10	QNS
19-Sep-88	8263005	RPT-1 Pass 10	46
19-Sep-88	8263008	RPT-1 Pass 10	35
19-Sep-88	8256002		220
19-Sep-88	8263009	Feed 3	330

QNS - Quantity Not Sufficient

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

TABLE 2
DEMONSTRATION 2 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Oil Method(1)	PCB (ppm dry wt.) Method 8080 (2)	PCB (mg/l) Method 608 (3)
13-Sep-88	8257027	EPT-1 Pass 1	< 510		
14-Sep-88	8258031	EPT-1 Pass 3	< 200		
19-Sep-88	8263016	EPT-1 Pass 10	190		
12-Sep-88	8256002	S-1 Pass 1		217	
13-Sep-88	8257028	S-1 Pass 2		< 166	
14-Sep-88	8258030	S-1 Pass 3		31	
15-Sep-88	8259024	S-1 Pass 4		28	
16-Sep-88	8260006	S-1 Pass 5		28	
16-Sep-88	8260007	S-1 Pass 6		6.8 J	
16-Sep-88	8260009	S-1 Pass 7		26	
19-Sep-88	8263013	S-1 Pass 8		28	
19-Sep-88	8263014	S-1 Pass 10		24	
23-Aug-88	8236027	Harbor Water			< 1
13-Sep-88	8257030	Tap Water-1			< 1
14-Sep-88	8258028	Harbor Water			< 1
26-Sep-88	8270016	Gasoline Wash EPT W-1	580		
26-Sep-88	8270017	Gasoline Wash EPT W20-1	570		
08-Dec-88	8263016	EPT-1, P-10	190 J		

(1) U.S. EPA,"The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oils,"EPA-600/4-81-045, U.S. EPA Washington, D.C., 1982

(2) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

(3) U.S. EPA,"Method 608-Organochlorine Pesticides and PCBs" Federal Register 40 CFR Part 136 Friday Oct. 26, 1984

(4) Flagged values (J) indicates the arochlor sum as being < 2X (RL 1242 +RL 1254) where RL represents the reporting limit.

DEMONSTRATION 3 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Oil Method (1)	PCB (ppm dry wt.) Method 8080 (1)
19-Sep-88	8263006	FK-1 Pass 1		204
19-Sep-88	8263017	FK-1 Pass 1		212
19-Sep-88	8263027	FK-1R Pass 1 Grab 2		360
19-Sep-88	8263028	FK-1R Pass 1 Grab 3		340
20-Sep-88	8264022	FK-1 Pass 2		< 112
20-Sep-88	8264020	RPT-1 Pass 1		47
20-Sep-88	8264021	RPT-1 Pass 2		72
21-Sep-88	8265069	RPT-1 Pass 3		< 134
21-Sep-88	8265070	RPT-1 Pass 3 Grab 2		529
21-Sep-88	8265071	RPT-1 Pass 3 Grab 3		49
21-Sep-88	8265072	RPT-1 Pass 3 Grab 4		66
21-Sep-88	8265067	EPT-1 Pass 1	910	
26-Sep-88	8270010	EPT-1 Pass 3 Grab 1	2910	
26-Sep-88	8270011	EPT-1 Pass 3 Grab 2	2300	
26-Sep-88	8270012	EPT-1 Pass 3 Grab 3	2100	
26-Sep-88	8270013	EPT-1 Pass 3 Grab 4	1880	
19-Sep-88	8263007	S-1 Pass 1		113
20-Sep-88	8264023	S-1 Pass 2		< 74
20-Sep-88	8264024	S-1 Pass 3		< 74
21-Sep-88	8265068	F2-1 Pass 3		12 J
26-Sep-88	8270018	Still Bottom Residue Pass 1	3400	

(1) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

(2) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

(3) Flagged values (J) indicate the arochlor sum as being < 2X (RL 1242 + RL 1254) where RL represents the reporting limit.

TABLE 1
DEMONSTRATION 4 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Method 8080 (1)
21-Sep-88	8265059	FK-1 Pass 1 Grab 1	3150
21-Sep-88	8265060	FK-1 Pass 1 Grab 2	3080
21-Sep-88	8265061	FK-1 Pass 1 Grab 3	1950
21-Sep-88	8265062	FK-1 Pass 1 Grab 4	2030
22-Sep-88	8266022	RPT-1 Pass 1	1000
23-Sep-88	8267013	RPT-1 Pass 2	990
27-Sep-88	8271008	RPT-1 Pass 3	820
27-Sep-88	8271009	RPT-1R Pass 3	523
29-Sep-88	8273001	RPT-1R Pass 4	290
29-Sep-88	8273002	RPT-1 Pass 4	360
30-Sep-88	8274027	RPT-1 Pass 5	240
30-Sep-88	8274029	RPT-1 Pass 6	< 220

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

DEMONSTRATION 4 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Oil Method (1)	PCB (ppm dry wt.) Method 8080 (2)
27-Sep-88	8271015	EPT-1 Pass 4 Grab 1	5400	
27-Sep-88	8271016	EPT-1 Pass 4 Grab 2	5400	
27-Sep-88	8271017	EPT-1 Pass 4 Grab3	6000	
27-Sep-88	8271018	EPT-1 Pass 4 Grab 4	5383	
30-Sep-88	8274031	EPT-1 Pass 6	5000	
21-Sep-88	8265063	S-1 Pass 1		2320
22-Sep-88	8266023	S-1 Pass 2		1380
23-Sep-88	8267014	S-1 Pass 3		730
27-Sep-88	8271010	S-1 Pass 4		1720
27-Sep-88	8271011	S-1R Pass 4		547
30-Sep-88	8274028	S-1 Pass 5		389
01-Oct-88	8275002	S-1 Pass 6		170 J
01-Oct-88	8275001	F-2-1 Pass 6		175

(1) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

(2) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

(3) Flagged values (J) indicate the arochlor sum as being < 2X (RL 1242 + RL 1254) where RL represents the reporting value.

DEMONSTRATION 4 STUDY
RADIAN LABORATORY EXTRACT
PCB Results By Method 8080 (1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry weight)
02-Oct-88	8298001	FK-1	8400

(1) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs," EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Ed., U.S. EPA. Washington, D.C., 1986

DEMONSTRATION 5 STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Oil Method (1)
01-Oct-88	8275004	RPT-1 Pass 3	< 200
01-Oct-88	8275005	RPT2-1 Pass 3	< 200
01-Oct-88	8275003	EPT-1 Pass 3	< 200

(1) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

SITE CHARACTERIZATION STUDY
First Sampling
PCB Results by Spittler Method(1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.)
12-Aug-88	8225013	1	26
12-Aug-88	8225015	2	6.7
12-Aug-88	8225017	3	37
12-Aug-88	8225019	4	< 5
12-Aug-88	8225021	5	6.8
12-Aug-88	8225023	6	< 5
12-Aug-88	8225025	7	18
12-Aug-88	8225027	8	15
12-Aug-88	8225029	9	30
12-Aug-88	8225031	10	11

(1) Fowler,B.A. and Bennet,J.T., "Screening for Characterization of PCB-Containing Soils and Sediments" E.C. Jordan Co. 1987

SITE CHARACTERIZATION STUDY
Second Sampling
PCB Results by Spittler Method(1)

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.)
07-Oct-88	8281005	Loc-1	5.4
07-Oct-88	8281006	Loc-2	< 0.5
07-Oct-88	8281007	Loc-3	1.8
07-Oct-88	8281008	Loc-4	4.9
07-Oct-88	8281009	Loc-5	11
07-Oct-88	8281010	Loc-6	< 0.5
07-Oct-88	8281011	Loc-7	2.3
07-Oct-88	8281012	Loc-8	< 0.5
07-Oct-88	8281013	Loc-9	23
07-Oct-88	8281014	Loc-10	4.8

(1) Fowler,B.A. and Bennett,J.T.,"Screening for Characterization of PCB-Containing Soils and Sediments" E.C. Jordan Co. 1987

CLEAN UP STUDY
PCB Results

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	PCB (ppm dry wt.) Oil Method (1)
05-Oct-88	8279013	RPT-1-1	200
05-Oct-88	8279014	RPT-1-2	190
05-Oct-88	8279015	RPT-1-3	170
05-Oct-88	8279016	RPT-1-4	180
05-Oct-88	8279017	RPT-2-1	34
05-Oct-88	8279018	RPT-2-2	32
05-Oct-88	8279019	RPT-2-3	37
05-Oct-88	8279020	RPT-2-4	33
05-Oct-88	8279021	EPT-1	970
05-Oct-88	8279022	EPT-1-2	800
05-Oct-88	8279023	EPT-1-3	770
05-Oct-88	8279024	EPT-1-4	830
05-Oct-88	8279025	EPT-1A-1	72
05-Oct-88	8279026	EPT-1A-2	55
05-Oct-88	8279027	EPT-1A-3	56
05-Oct-88	8279028	EPT-1A-4	56
07-Oct-88	8281015	CC-1	1.2 *

(1) U.S. EPA-SW846, Method 3580/8080, 3rd Ed., 1986

(*) U.S. EPA, "Method 8080-Organochlorine Pesticides and PCBs,"
EPA SW-846 Test Methods for Evaluating Solid Waste,
3rd Ed., U.S. EPA. Washington, D.C., 1986

Appendix C

Total Residue, PCB, Oil & Grease, pH, Cyanide, Total Suspended Solids, Total Dissolved Solids, and Methylene Blue Active Substances Results of Analysis

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Splitter Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Bench 1	F-1	8155054	03-Jun-88	Sediment					56						
Bench 1	F-2	8155055	03-Jun-88	Sediment					42						
Bench 1	F-3	8155056	03-Jun-88	Sediment					38						
Bench 1	F-4	8155057	03-Jun-88	Sediment					1900						
Bench 1	F-5	8155058	03-Jun-88	Sediment					1100						
Bench 1	F-6	8155059	03-Jun-88	Sediment					1700						
Bench 1	E1-1A	8156001	04-Jun-88	Oil					18000*						
Bench 1	E1-1B	8156002	04-Jun-88	Oil					20000*						
Bench 1	E1-1C	8156003	04-Jun-88	Oil					< 530*						
Bench 1	E1-1D	8156004	04-Jun-88	Oil					< 2000*						
Bench 1	E1-1E	8156005	04-Jun-88	Oil					15000*						
Bench 1	E1-1F	8156006	04-Jun-88	Oil					15000*						
Bench 1	E1-1G	8156007	04-Jun-88	Oil					16000*						
Bench 1	E2-2A	8156008	04-Jun-88	Oil					250000*						
Bench 1	E2-2B	8156009	04-Jun-88	Oil					180000*						
Bench 1	E2-2C	8156010	04-Jun-88	Oil					140000*						
Bench 1	E2-2D	8156011	04-Jun-88	Oil					Vial broken at time of receipt						
Bench 1	E2-2E	8156012	04-Jun-88	Oil					16000*						
Bench 1	E2-2F	8156013	04-Jun-88	Oil					170000*						
Bench 1	E2-2G	8156014	04-Jun-88	Oil					29000*						

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Arochlor 1242 Method 8080 (ppm dry)	Arochlor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Bench 1	E2-2H	8156015	04-Jun-88	Oil					45000*						
Bench 1	E2-2I	8156016	04-Jun-88	Oil					78000*						
Bench 2	Feed WQL 3309	8189021	07-Jul-88	Sediment	49	3400									
Bench 2	Feed J-13-2	8199022	07-Jul-88	Sediment	63	220									
Bench 2	Sludge 1	8197004	15-Jul-88	Sediment	48	6200									
Bench 2	Sludge 2	8197005	15-Jul-88	Sediment	49	4600									
Bench 2	Sludge 3	8200001	18-Jul-88	Sediment	51	3800									
Bench 2	Sludge 4	8201007	19-Jul-88	Sediment	50	3300									
Bench 2	Sludge 6	8202007	20-Jul-88	Sediment	64	210									
Bench 2	Sludge 7	8202008	20-Jul-88	Sediment	61	170									
Bench 2	Sludge 8	8203035	21-Jul-88	Sediment	65	23									
Bench 2	Sludge 9	8204016	22-Jul-88	Sediment	62	68									
Bench 2	Sludge 10	8204017	22-Jul-88	Sediment	65	54									
Bench 2	Sludge 11	8224020	11-Aug-88	Sediment	48	5300									
Bench 2	Sludge 12	8224021	11-Aug-88	Sediment	54	4000									
Bench 2	Sludge 13	8224022	11-Aug-88	Sediment	53	1600									
Bench 2	Oil 1	8201009	19-Jul-88	Oil		70000									
Bench 2	Oil 2	8201010	19-Jul-88	Oil		280000									
Bench 2	Oil 3	8201011	19-Jul-88	Oil		170000									
Bench 2	Oil 4	8201012	19-Jul-88	Oil		390000									

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Bench 2	Oil 5	8201013	19-Jul-88	Oil		47000									
Bench 2	Oil 6	8201014	19-Jul-88	Oil		390000									
Bench 2	Oil 7	8201015	19-Jul-88	Oil		260000									
Bench 2	Oil 8	8201016	19-Jul-88	Oil		160000									
Bench 2	Oil 9	8201017	19-Jul-88	Oil		50000									
Bench 2	Oil 10	8207001	25-Jul-88	Oil		19000									
Bench 2	Oil 11	8207002	25-Jul-88	Oil		7700									
Bench 2	Oil 12	8207003	25-Jul-88	Oil		37000									
Bench 2	Oil 13	8207004	25-Jul-88	Oil		38000									
Bench 2	Oil 14	8207005	25-Jul-88	Oil		46000									
Bench 2	Oil 15	8207006	25-Jul-88	Oil		27000									
Bench 2	Oil 16	8204018	22-Jul-88	Oil		6600									
Bench 2	Oil 17	8204019	22-Jul-88	Oil		2400									
Bench 2	Oil 18	8204020	22-Jul-88	Oil		1300									
Bench 2	Oil 19	8204021	22-Jul-88	Oil		850									
Bench 2	Oil 20	8224017	11-Aug-88	Oil		81000									
Bench 2	Oil 21	8224018	11-Aug-88	Oil		660000									
Bench 2	Oil 22	8224019	11-Aug-88	Oil		350000									
Bench 2	Sludge 14	8224023	11-Aug-88	Sediment	54	430				0.088					
Bench 3	Sludge 15	8246001	02-Sep-88	Sediment	35	210									

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Bench 3	Sludge 16	8246002	02-Sep-88	Sediment	35	340									
Bench 3	Sludge 17	8246003	02-Sep-88	Sediment	35	57									
Bench 3	Oil 23A,B	8246005-6	02-Sep-88	Oil		33000									
Bench 3	Oil 24A,B,C,D	8246007-010	02-Sep-88	Oil		67000									
Bench 3	Sludge 18	8246004	02-Sep-88	Sediment	37	17				0.358					
Bench 3+	Sludge 19	8257019	13-Sep-88	Sediment	29	11000			QNS @	6.6					
Bench 3+	Sludge 20	8257020	13-Sep-88	Sediment	27	5800			QNS @	1.0					
Bench 3+	Sludge 21	8257021	13-Sep-88	Sediment	27	940			QNS @	0.21					
Bench 3+	Sludge 22	8257022	13-Sep-88	Sediment	30	220			QNS @	0.71					
Bench 3+	Oil 25	8257026	13-Sep-88	Oil		54000*			QNS @						
Bench 3+	Oil 26	8257023	13-Sep-88	Oil		13000*			QNS @						
Bench 3+	Oil 27	8257024	13-Sep-88	Oil		150000*			QNS @						
Bench 3+	Oil 28	8257025	13-Sep-88	Oil		140000*			QNS @						
Demo 1	EPT-1	8251003	07-Sep-88	Sediment	N/A		< 100	< 100	< 200						
Demo 1	FK-1	8251002	07-Sep-88	Sediment	27		260	100	360						
Demo 1	RPT-1	8251001	07-Sep-88	Sediment	1.6		< 420	< 420	< 840						
Demo 2	EPT-1 Pass 1	8257027	13-Sep-88	Oil	N/A		< 100*	< 410*	< 510*						
Demo 2	EPT-1 Pass 3	8258031	14-Sep-88	Oil	N/A		< 100*	< 100*	< 200*	81					
Demo 2	EPT-1 Pass 10	8263016	19-Sep-88	Oil	N/A		190*	< 1000*	190*	71					
Demo 2	Feed 3	8263009	19-Sep-88	Sediment	17		220	110	330						

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Splitter Method (ppm dry)	Arochlor 1242 Method 8080 (ppm dry)	Arochlor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Demo 2	FK-1 Pass 1	8253002	09-Sep-88	Sediment	23		250	100	350	2.2	8.0				
Demo 2	FK-1 Pass 4	8259023	15-Sep-88	Sediment	15		18	12	30	0.84	8.2				
Demo 2	FK-1 Pass 10	8263015	19-Sep-88	Sediment	57				QNS @						
Demo 2	Harbor Water	8258028	14-Sep-88	Water					<1#				28	34000	<0.040
Demo 2	Resi Feed Low 2 Pass	8257029	13-Sep-88	Sediment	14		170	48	170						
Demo 2	RPT-1 Pass 1	8256003	12-Sep-88	Sediment	15		47	30	77						
Demo 2	RPT-1 Pass 2	8258029	14-Sep-88	Sediment	14		33	19	52						
Demo 2	RPT-1 Pass 3	8259022	15-Sep-88	Sediment	18		4.8	5.3	10	0.34	8.2				
Demo 2	RPT-1 Pass 4	8260004	16-Sep-88	Sediment	8		32	34	66						
Demo 2	RPT-1 Pass 5	8260005	16-Sep-88	Sediment	9		26	33	59						
Demo 2	RPT-1 Pass 6	8260008	16-Sep-88	Sediment	9		18	23	41						
Demo 2	RPT-1 Pass 7	8263010	19-Sep-88	Sediment	6.9		16	20	36						
Demo 2	RPT-1 Pass 8	8263011	19-Sep-88	Sediment	9.1		15	14	29						
Demo 2	RPT-1 Pass 9	8263012	19-Sep-88	Sediment	9		< 7.4	7.8	7.8						
Demo 2	RPT-1 Pass 10	8263008	19-Sep-88	Sediment	9		5.6	29	35						
Demo 2	RPT-1 Pass 10	8263005	19-Sep-88	Sediment	9		10	36	46	0.93	8.2				
Demo 2	S-1 Pass 1	8256002	12-Sep-88	Sediment	19		150	67	220						
Demo 2	S-1 Pass 2	8257028	13-Sep-88	Sediment	8		< 83	< 83	< 170						
Demo 2	S-1 Pass 3	8258030	14-Sep-88	Sediment	19		18	13	31						
Demo 2	S-1 Pass 4	8259024	15-Sep-88	Sediment	14		18	10	28						

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Splitter Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Demo 2	S-1 Pass 5	8260006	16-Sep-88	Sediment	17		15	13	28						
Demo 2	S-1 Pass 6	8260007	16-Sep-88	Sediment	13		6.8	< 5.2	6.8						
Demo 2	S-1 Pass 7	8260009	16-Sep-88	Sediment	14		7.7	18	26						
Demo 2	S-1 Pass 8	8263013	19-Sep-88	Sediment	11		15	13	28						
Demo 2	S-1 Pass 10	8263014	19-Sep-88	Sediment	14		5.6	18	24						
Demo 2	Tap Water-1	8257030	13-Sep-88	Water					<1#				<4.0	62	<0.040
Demo 3	EPT-1 Pass 1	8265067	21-Sep-88	Oil	N/A		580*	330*	910*						
Demo 3	EPT-1 Pass 3	8270015	26-Sep-88	Oil						27					
Demo 3	EPT-1 Pass 3 Grab 1	8270010	26-Sep-88	Oil	N/A		2000*	910*	2910*						
Demo 3	EPT-1 Pass 3 Grab 2	8270011	26-Sep-88	Oil	N/A		1200*	1100*	2300*						
Demo 3	EPT-1 Pass 3 Grab 3	8270012	26-Sep-88	Oil	N/A		1300*	800*	2100*						
Demo 3	EPT-1 Pass 3 Grab 4	8270013	26-Sep-88	Oil	N/A		1200*	680*	1880*						
Demo 3	F2-1 Pass 3	8265068	21-Sep-88	Sediment	54		7.2	4.7	12						
Demo 3	FK-1 Pass 1	8263006	19-Sep-88	Sediment	16		140	64	200						
Demo 3	FK-1R Pass 1 Grab 2	8263027	19-Sep-88	Sediment	13		240	120	360						
Demo 3	FK-1R Pass 1 Grab 3	8263028	19-Sep-88	Sediment	11		220	120	340						
Demo 3	FK-1 Pass 1	8263017	19-Sep-88	Sediment	13		150	62	210						
Demo 3	FK-1 Pass 1	8263018	19-Sep-88	Sediment	18					1.9	8.3				
Demo 3	FK-1 Pass 2	8264022	20-Sep-88	Sediment	12		< 56	< 56	< 110						
Demo 3	RPT-1 Pass 1	8264020	20-Sep-88	Sediment	15		28	19	47						

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Demo 3	RPT-1 Pass 2	8264021	20-Sep-88	Sediment	12		36	36	72						
Demo 3	RPT-1 Pass 3	8265065	21-Sep-88	Sediment	10					<0.025	8.1				
Demo 3	RPT-1 Pass 3	8265069	21-Sep-88	Sediment	10		< 67	< 67	< 130						
Demo 3	RPT-1 Pass 3 Grab 2	8265070	21-Sep-88	Sediment	12		440	89	530						
Demo 3	RPT-1 Pass 3 Grab 3	8265071	21-Sep-88	Sediment	11		29	20	49						
Demo 3	RPT-1 Pass 3 Grab 4	8265072	21-Sep-88	Sediment	12		42	24	66						
Demo 3	Still Bot. Resi. Pass 1	8270018	26-Sep-88	Oil	N/A		2300*	1100*	3400*						
Demo 3	S-1 Pass 1	8263007	19-Sep-88	Sediment	40		77	36	110						
Demo 3	S-1 Pass 2	8264023	20-Sep-88	Sediment	18		< 37	< 37	< 74						
Demo 3	S-1 Pass 3	8264024	20-Sep-88	Sediment	18		< 37	< 37	< 74						
Demo 4	EPT-1 Pass 4	8271013	27-Sep-88	Oil						77					
Demo 4	EPT-1 Pass 4	8271014	27-Sep-88	Oil											
Demo 4	EPT-1 Pass 4	8273004	29-Sep-88	Oil	Sent to Radian Method ((680))										
Demo 4	EPT-1 Pass 4 Grab 1	8271015	27-Sep-88	Oil	N/A		3100*	2300*	5400*						
Demo 4	EPT-1 Pass 4 Grab 2	8271016	27-Sep-88	Oil	N/A		3100*	2300*	5400*						
Demo 4	EPT-1 Pass 4 Grab 3	8271017	27-Sep-88	Oil	N/A		3700*	2300*	6000*						
Demo 4	EPT-1 Pass 4 Grab 4	8271018	27-Sep-88	Oil	N/A		3100*	2300*	5400*						
Demo 4	EPT-1 Pass 6	8274031	30-Sep-88	Oil	N/A		2900*	2100*	5000*	75					
Demo 4	FK-1 Pass 1	8273005	29-Sep-88	Sediment	Sent to Radian Method ((680))										
Demo 4	FK-1 Pass 1	8265066	21-Sep-88	Sediment	16					3.3	8.2				

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Splitter Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Demo 4	FK-1 Pass 1 Grab 1	8265059	21-Sep-88	Sediment	13		2200	950	3200						
Demo 4	FK-1 Pass 1 Grab 2	8265060	21-Sep-88	Sediment	17		2700	380	3100						
Demo 4	FK-1 Pass 1 Grab 3	8265061	21-Sep-88	Sediment	17		1200	750	2000						
Demo 4	FK-1 Pass 1 Grab 4	8265062	21-Sep-88	Sediment	18		1300	730	2000						
Demo 4	FK-1 Radian Extract	8298001	24-Oct-88	Hexane Ext.	14		8300	< 3600	8300						
Demo 4	F-2-1 Pass 6	8275001	01-Oct-88	Sediment	19		120	55	180						
Demo 4	PCB Removal High Feed	8265064	21-Sep-88	Sediment	This sample is on hold										
Demo 4	RPT-1 Pass 1	8266022	22-Sep-88	Sediment	13		860	140	1000						
Demo 4	RPT-1 Pass 2	8267013	23-Sep-88	Sediment	12		850	140	990						
Demo 4	RPT-1 Pass 3	8271008	27-Sep-88	Sediment	10		650	170	820						
Demo 4	RPT-1R Pass 3	8271009	27-Sep-88	Sediment	11		450	73	520						
Demo 4	RPT-1 Pass 4	8273002	29-Sep-88	Sediment	6.9		360	< 97	360						
Demo 4	RPT-1R Pass 4	8273001	29-Sep-88	Sediment	7.6		290	< 88	290						
Demo 4	RPT-1 Pass 4	8273003	29-Sep-88	Sediment	Sent to Radian Method ((680))										
Demo 4	RPT-1 Pass 5	8274027	30-Sep-88	Sediment	7.2		240	< 93	240						
Demo 4	RPT-1 Pass 6	8274030	30-Sep-88	Sediment	5.6					0.48					
Demo 4	RPT-1 Pass 6	8274029	30-Sep-88	Sediment	6.5		< 100	< 100	< 200						
Demo 4	S-1 Pass 1	8265063	21-Sep-88	Sediment	17		1600	720	2300						
Demo 4	S-1 Pass 2	8266023	22-Sep-88	Sediment	10		1200	180	1400						
Demo 4	S-1 Pass 3	8267014	23-Sep-88	Sediment	10		630	100	730						

@ QNS indicates quantity not sufficient.

- Units for oil samples are ppm wet wt.
  Extraction Method used for oil samples is described in U.S.EPA
  SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

42

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Demo 4	S-1 Pass 4	8271010	27-Sep-88	Sediment	12		940	780	1700						
Demo 4	S-1R Pass 4	8271011	27-Sep-88	Sediment	13		460	87	550						
Demo 4	S-1 Pass 5	8274028	30-Sep-88	Sediment	11		320	69	390						
Demo 4	S-1-1 Pass 6	8275002	01-Oct-88	Sediment	7		170	< 95	170						
Demo 5	EPT-1 Pass 3	8275003	01-Oct-88	Oil	N/A		< 100*	< 100*	< 200*						
Demo 5	RPT2-1 Pass 3	8275005	01-Oct-88	Oil	N/A		< 100*	< 100*	< 200*						
Demo 5	RPT-1 Pass 3	8275004	01-Oct-88	Oil	N/A		< 100*	< 100*	< 200*						
Drum Char	Composite 1	8236025	23-Aug-88	Sediment	35		5800	3000	8800						
Drum Char	Composite 1R	8236026	23-Aug-88	Sediment	36		630	360	990			8.6			
Drum Char	H-20-1	8236016	23-Aug-88	Sediment	28		340	130	470	2.7					
Drum Char	H-20-2	8236017	23-Aug-88	Sediment	29		220	75	300	3.8					
Drum Char	H-20-3	8236018	23-Aug-88	Sediment	30		310	130	440						
Drum Char	H-21-1	8236013	23-Aug-88	Sediment	34		200	160	360	1.5					
Drum Char	H-21-2	8236014	23-Aug-88	Sediment	34		180	110	290	1.5					
Drum Char	H-21-3	8236015	23-Aug-88	Sediment	35		210	140	350						
Drum Char	H-22-1	8231017	18-Aug-88	Sediment	30		270	260	530						
Drum Char	H-22-2	8231018	18-Aug-88	Sediment	30		240	220	460						
Drum Char	H-22-3	8231019	18-Aug-88	Sediment	29		500	430	930						
Drum Char	H-23-1	8236022	23-Aug-88	Sediment	42		52	50	100	1.3					
Drum Char	H-23-2	8236023	23-Aug-88	Sediment	43		140	94	230	1.1					

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Arochlor 1242 Method 8080 (ppm dry)	Arochlor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Drum Char	H-23-3	8236024	23-Aug-88	Sediment	44		85	66	150						
Drum Char	I-11-1	8236007	23-Aug-88	Sediment	45		28000	3900	32000	6.7					
Drum Char	I-11-2	8236008	23-Aug-88	Sediment	29		25000	2800	28000	7.6					
Drum Char	I-11-3	8236009	23-Aug-88	Sediment	30		32000	5300	37000						
Drum Char	J-7-1	8231014	18-Aug-88	Sediment	28		6900	6700	14000						
Drum Char	J-7-2	8231015	18-Aug-88	Sediment	27		< 4900	50000	50000						
Drum Char	J-7-3	8231016	18-Aug-88	Sediment	30		6900	51000	58000						
Drum Char	L-7-1	8231011	18-Aug-88	Sediment	39		260	100	360						
Drum Char	L-7-2	8231012	18-Aug-88	Sediment	38		230	82	310	0.6					
Drum Char	L-7-3	8231013	18-Aug-88	Sediment	40		480	160	640						
Drum Char	L-8-1	8236019	23-Aug-88	Sediment	34		250	83	330	1.2					
Drum Char	L-8-2	8236020	23-Aug-88	Sediment	43		230	73	300	0.7					
Drum Char	L-8-3	8236021	23-Aug-88	Sediment	46		210	62	270						
Drum Char	L-9-1	8236010	23-Aug-88	Sediment	58		2200	710	2900	1.3					
Drum Char	L-9-2	8236011	23-Aug-88	Sediment	50		1900	1200	3100	1.2	6.9				
Drum Char	L-9-3	8236012	23-Aug-88	Sediment	52		2600	1500	4100						
Site Char	1	8225013	12-Aug-88	Sediment	94	26									
Site Char	2	8225015	12-Aug-88	Sediment	90	6.7									
Site Char	3	8225017	12-Aug-88	Sediment	84	37									
Site Char	4	8225019	12-Aug-88	Sediment	80	< 5									

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

# Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Aroclor 1242 Method 8080 (ppm dry)	Aroclor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Site Char	5	8225021	12-Aug-88	Sediment	81	6.8									
Site Char	6	8225023	12-Aug-88	Sediment	85	< 5									
Site Char	7	8225025	12-Aug-88	Sediment	79	18									
Site Char	8	8225027	12-Aug-88	Sediment	91	15									
Site Char	9	8225029	12-Aug-88	Sediment	76	30									
Site Char	10	8225031	12-Aug-88	Sediment	87	11									
Site Char.	Loc-1	8281005	07-Oct-88	Sediment	92	5.4									
Site Char.	Loc-2	8281006	07-Oct-88	Sediment	91	< 0.5									
Site Char.	Loc-3	8281007	07-Oct-88	Sediment	89	1.8									
Site Char.	Loc-4	8281008	07-Oct-88	Sediment	87	4.9									
Site Char.	Loc-5	8281009	07-Oct-88	Sediment	87	11									
Site Char.	Loc-5	8281010	07-Oct-88	Sediment	93	< 0.5									
Site Char.	Loc-7	8281011	07-Oct-88	Sediment	90	2.3									
Site Char.	Loc-8	8281012	07-Oct-88	Sediment	92	< 0.5									
Site Char.	Loc-9	8281013	07-Oct-88	Sediment	89	23									
Site Char.	Loc-10	8281014	07-Oct-88	Sediment	93	4.8									
Demo 2	EPT W-1	8270016	26-Sep-88	Gasoline	N/A		360 #	200 #	560 #						
Demo 2	EPT W 20-1	8270017	26-Sep-88	Gasoline	N/A		140 #	430 #	570 #						
Clean-up	EPT-1	8279021	05-Oct-88	Toluene	N/A		790 #	180 #	970 #	61					
Clean-up	EPT-1A-1	8279025	05-Oct-88	Toluene	N/A		57 #	15 #	72 #						

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

SAIC/CF Systems Summary (Excluding Metals & GC/MS Parameters)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Total Residue (%)	PCB Spittler Method (ppm dry)	Arochlor 1242 Method 8080 (ppm dry)	Arochlor 1254 Method 8080 (ppm dry)	Total PCB Method 8080 (ppm dry)	Oil & Grease (% dry)	pH	Cyanide (ug)	TSS (ppm)	TDS (ppm)	MBAS (mg/l)
Clean-up	EPT-1A-2	8279026	05-Oct-88	Toluene	N/A		44 #	11 #	55 #						
Clean-up	EPT-1A-3	8279027	05-Oct-88	Toluene	N/A		56 #	< 10 #	56 #						
Clean-up	EPT-1A-4	8279028	05-Oct-88	Toluene	N/A		56 #	< 10 #	56 #						
Clean-up	EPT-1-2	8279022	05-Oct-88	Toluene	N/A		660 #	140 #	800 #						
Clean-up	EPT-1-3	8279023	05-Oct-88	Toluene	N/A		630 #	140 #	770 #						
Clean-up	EPT-1-4	8279024	05-Oct-88	Toluene	N/A		660 #	170 #	830 #						
Clean-up	RPT-1-1	8279013	05-Oct-88	Toluene	N/A		200 #	< 100 #	200 #	34					
Clean-up	RPT-1-2	8279014	05-Oct-88	Toluene	N/A		190 #	< 100 #	190 #						
Clean-up	RPT-1-3	8279015	05-Oct-88	Toluene	N/A		170 #	< 100 #	170 #						
Clean-up	RPT-1-4	8279016	05-Oct-88	Toluene	N/A		180 #	< 100 #	180 #						
Clean-up	RPT-2-1	8279017	05-Oct-88	Toluene			19 #	15 #	34 #	21					
Clean-up	RPT-2-2	8279018	05-Oct-88	Toluene	N/A		18 #	14 #	32 #						
Clean-up	RPT-2-3	8279019	05-Oct-88	Toluene	N/A		18 #	19 #	37 #						
Clean-up	RPT-2-4	8279020	05-Oct-88	Toluene	N/A		16 #	17 #	33 #						
Clean-up	CC-1	8281015	07-Oct-88	Sediment	71	1.2									

@ QNS indicates quantity not sufficient.

* Units for oil samples are ppm wet wt.
Extraction Method used for oil samples is described in U.S.EPA
SW846, Method 3580/8080, 3rd Ed., 1986

Units for water/gasoline/toluene samples are mg/l.

Appendix D

Elements, Semivolatile Organics and Particle Size Results of Analysis

Elemental Results of Analysis

DRUM CHARACTERIZATION

Date Received	E.C. Jordan Sample ID.	SAIC Sample ID.	Analyte	Concentration (mg/kg) dry wt.
02-Sep-88	8266025	Composite 1	Silver	4.4
"	"	"	Aluminum	10000
"	"	"	Arsenic	20
"	"	"	Barium	140
"	"	"	Beryllium	7
"	"	"	Calcium	2700
"	"	"	Cadmium	32
"	"	"	Cobalt	10
"	"	"	Chromium	430
"	"	"	Copper	1100
"	"	"	Iron	16000
"	"	"	Mercury	1.1
"	"	"	Potassium	2100
"	"	"	Magnesium	5100
"	"	"	Manganese	220
"	"	"	Sodium	11000
"	"	"	Nickel	130
"	"	"	Lead	600
"	"	"	Antimony	6.6
"	"	"	Selenium	< 0.23
"	"	"	Thallium	< 0.11
"	"	"	Vanadium	100
"	"	"	Zinc	1900
02-Sep-88	8266026	Composite 1R	Silver	4.6
"	"	"	Aluminum	10000
"	"	"	Arsenic	4.1
"	"	"	Barium	140
"	"	"	Beryllium	0.57
"	"	"	Calcium	2400
"	"	"	Cadmium	25
"	"	"	Cobalt	7.7
"	"	"	Chromium	420
"	"	"	Copper	700
"	"	"	Iron	17000
"	"	"	Mercury	1.6
"	"	"	Potassium	2300
"	"	"	Magnesium	5400
"	"	"	Manganese	150
"	"	"	Sodium	11000
"	"	"	Nickel	130
"	"	"	Lead	570
"	"	"	Antimony	9.1
"	"	"	Selenium	< 0.23
"	"	"	Thallium	< 0.11
"	"	"	Vanadium	39
"	"	"	Zinc	1800

Additional sample qualifiers can be found in the appendix.

SAIC/CF Systems Summary (Metals)

Project Phase	SAIC/CF Systems Sample ID	E.C.Jordan Sample ID	Receipt Date	Sample Matrix	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)	Arsenic EP Tox (mg/l)	Barium EP Tox (mg/l)	Cadmium EP Tox (mg/l)	Chromium EP Tox (mg/l)	Lead EP Tox (mg/l)	Mercury EP Tox (mg/l)	Selenium EP Tox (mg/l)	Silver EP Tox (mg/l)
Demo 2	EPT-1 Pass 10	8263016	19-Sep-88	Oil	NR	3.3	4.7	NR	4.7								
Demo 2	FK-1 Pass 4	8259023	15-Sep-88	Sediment	44.0	761	1990	792	2680								
Demo 2	FK-1 Pass-1	8253002	09-Sep-88	Sediment	35.7	596	1790	619	2150								
Demo 2	RPT-1 Pass 10	8263005	19-Sep-88	Sediment	42.8	816	1740	892	2610								
Demo 2	RPT-1 Pass 3	8259022	15-Sep-88	Sediment	32.5	581	1650	587	2220								
Demo 3	EPT-1 Pass 3	8270015	26-Sep-88	Oil	5.6	20	6	NR	7.6								
Demo 3	FK-1 Pass 1	8263018	19-Sep-88	Sediment	32.0	525	1320	520	1900								
Demo 3	RPT-1 Pass 3	8265065	21-Sep-88	Sediment	62.3	1020	2570	1100	3550								
Demo 4	EPT-1 Pass 4	8271014	27-Sep-88	Oil	5.0	26	4.8	35	13								
Demo 4	EPT-1 Pass 6	8274031	30-Sep-88	Oil	5.1	31	3.9	40	15								
Demo 4	FK-1 Pass 1	8265066	21-Sep-88	Sediment	87.5	1480	2650	1300	5370								
Demo 4	RPT-1 Pass 6	8274030	30-Sep-88	Sediment	120	1790	3700	1800	7260								
Demo 4	RPT-1 Pass 6	8274029	30-Sep-88	Sediment						< 0.005	0.36	0.30	0.053	0.16	< 0.20	< 0.020	< 0.015
Drum Char	Composite 1	8236025-5	23-Aug-88	Sediment						0.011	0.16	0.11	0.18	0.34	< 0.20	< 0.005	< 0.015
Drum Char	Composite 1R	8236026	23-Aug-88	Sediment						0.008	0.15	0.12	0.098	0.23	< 0.20	< 0.005	< 0.015
Wash/Tol	EPT-1	8279021	05-Oct-88	Oil	2.7	2.5	1.1	9.2	7.7								
Wash/Tol	RPT-1-1	8279013	05-Oct-88	Oil	0.91/2.7	0.15/< 1.5	2.6/3.0	4.6/4.2	< .015/1.3								
Wash/Tol	RPT-1-4	8279016	05-Oct-88	Oil	< 0.15	< 1.5	< 0.60	NR	2.2								

Semivolatile Organics Results of Analysis

PREDEMONSTRATION SEMIVOLATILES ANALYSES

Pollutant	Drum H-20 Sample 1	Drum H-20 Sample 2	Drum H-21 Sample 1	Drum H-21 Sample 2	Drum H-22 Sample 1	Drum H-22 Sample 2	Drum H-23 Sample 1	Drum H-23 Sample 2	Drum I-11 Sample 1	Drum I-11 Sample 2
Phenol										
bis(2-Chloroethyl) ether										
2-Chlorophenol										1.7E+04
1,3-Dichlorobenzene					< 280				9.3E+04	4.0E+05
1,4-Dichlorobenzene					< 600	< 510			2.5E+05	
Benzyl alcohol										
1,2-Dichlorobenzene										
2-Methylphenol										
bis-(2-Chloroisopropyl)ether										
4-Methylphenol			< 630		< 1500	< 1500				
N-Nitroso-di-n-propylamine										
Hexachloroethane										
Nitrobenzene										
Isophorone					< 980	< 610				
2-Nitrophenol										
2,4-Dimethylphenol					< 440	< 420				
Benzoic acid			< 7600		< 3800	< 4400			< 7500	
bis(2-Chloroethoxy)methane										
2,4-Dichlorophenol										
1,2,4-Trichlorobenzene						< 1200				< 2300
Napthalene	< 420		< 590	< 3700	7900	< 1300	< 1900	< 3800		< 570
4-Chloroaniline										
Hexachlorobutadiene										
4-Chloro-3-methylphenol										
2-Methylnaphthalene				< 1100	3200	< 1.0E+03	< 1100	< 910		
Hexachlorocyclopentadiene										
2,4,6-Trichlorophenol										
2,4,5-Trichlorophenol										
2-Chloronaphthalene									< 820	< 1400
2-Nitroaniline										
Dimethylphthalate									< 1800	
Acenaphthylene			< 940		4700	9900			< 1400	< 1900
2,6-Dinitrotoluene										
3-Nitroaniline										

Note: Blank indicates not detected.

"<" indicates detected less than the detection limit shown.

"E+" indicates base ten exponent.

PREDEMONSTRATION SEMIVOLATILES ANALYSES (Continued)

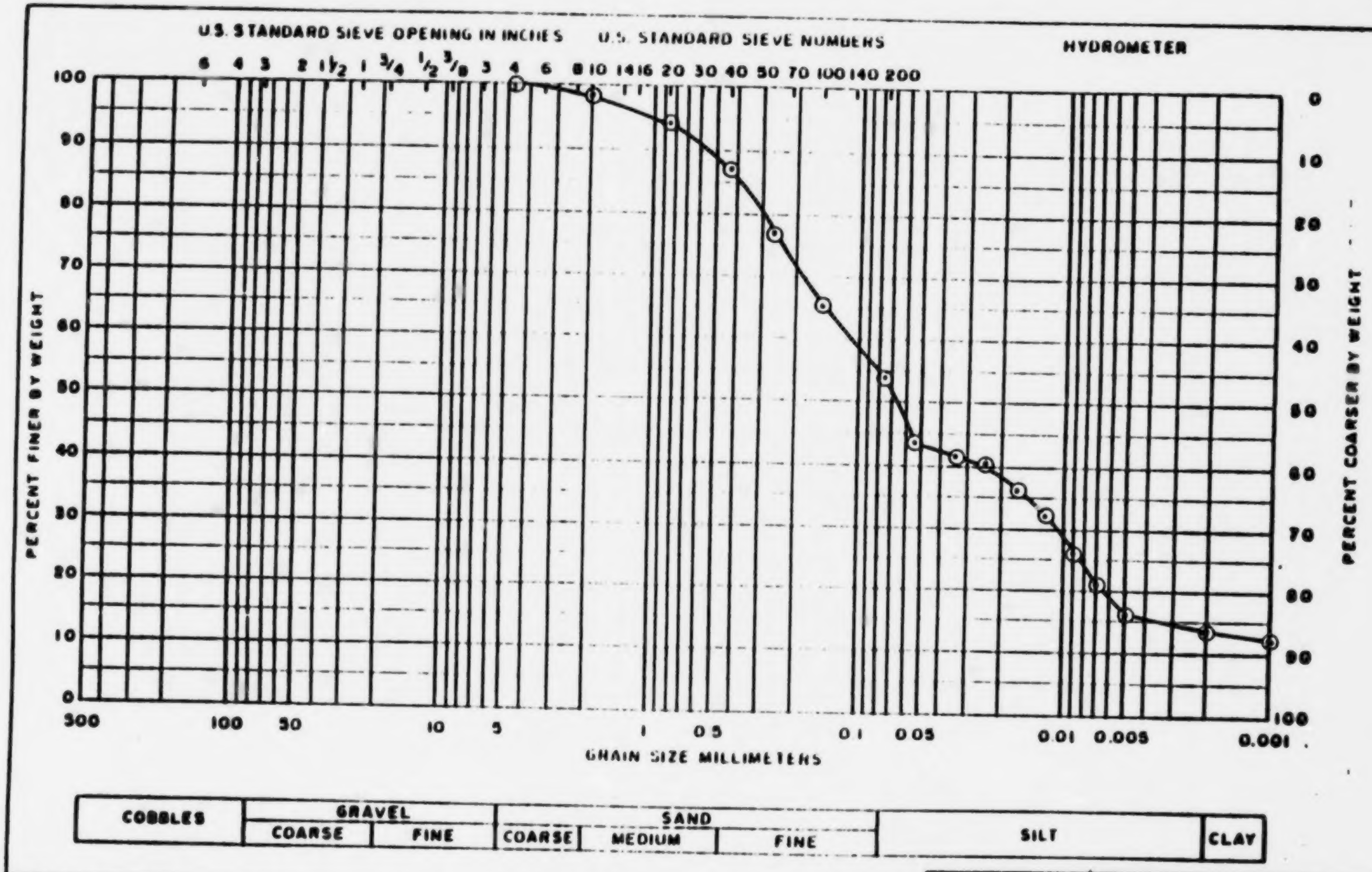
Pollutant	Drum N-20 Sample 1	Drum N-20 Sample 2	Drum N-21 Sample 1	Drum N-21 Sample 2	Drum N-22 Sample 1	Drum N-22 Sample 2	Drum N-23 Sample 1	Drum N-23 Sample 2	Drum I-11 Sample 1	Drum I-11 Sample 2
Acenaphthene	< 1100	< 1200	< 940	< 2700		3.0E+03		< 4600	< 840	< 1600
2,4-Dinitrophenol					5200					
4-Nitrophenol										
Dibenzofuran	< 860	< 840	< 740	< 2600	4800	< 2100		< 3800		< 770
2,4-Dinitrotoluene									1.9E+04	
Diethylphthalate										
4-Chlorophenyl-phenylether										
Fluorene	< 1200	< 1200	< 1100	< 3500	7200	4100		< 6.0E+03	< 650	< 1400
4-Nitroaniline										
4,6-Dinitro-2-methylphenol										
N-Nitrosodiphenylamine (1)										
4-Bromophenyl-phenylether										
Hexachlorobenzene										
Pentachlorophenol										
Phenanthrene	< 1.1E+04	< 9400	1.2E+04	2.2E+04	3.5E+04	3.0E+04	3.9E+04	5.9E+04		
Anthracene		< 1800	< 1900	< 3900	8100	8500	9.0E+03	1.4E+04	< 560	
Di-n-butylphthalate	< 2300	< 2800	< 2600	< 2300						
Fluoranthene	2.3E+04	1.9E+04	1.1E+04	2.6E+04		3.2E+04	4.2E+04	8.0E+04		< 140
Pyrene	< 1.1E+04	1.2E+04	1.6E+04	1.7E+04	5.1E+04	5.0E+04	3.5E+04	6.7E+04	1.2E+04	
Butylbenzylphthalate										
3,3'-Dichlorobenzidine										
Benzo(a)anthracene	< 7300	< 7600	< 7200	1.1E+04	3.5E+04	3.1E+04	1.8E+04	3.9E+04	< 7600	9700
Chrysene	1.3E+04	1.2E+04	1.2E+04	1.5E+04	3.4E+04	3.3E+04	2.8E+04	5.5E+04	1.3E+04	1.6E+04
bis(2-Ethylhexyl)phthalate	5.0E+04	5.6E+04	1.3E+04	1.0E+04	2.1E+04	1.7E+04	8200	1.3E+04	3.1E+04	2.8E+04
Di-n-octylphthalate	< 1300								< 470	< 550
Benzo(b)fluoranthene	14000	12000	< 590	1.7E+04	3.8E+04	3.6E+04	2.9E+04	4.9E+04	< 9700	1.2E+04
Benzo(k)fluoranthene			1.4E+04						1.2E+04	
Benzo(a)pyrene	< 7500	< 7300	< 6700	9800	2.1E+04	1.7E+04	1.7E+04	3.2E+04	< 7800	8200
Indeno(1,2,3-cd)pyrene	< 4700	< 4600	< 6900	< 6700			9600	1.8E+04	< 7400	< 5800
Dibenz(a,h)anthracene		< 6000	< 6800	< 5100	4800	3.0E+03	9400	1.7E+04	< 6800	< 5700
Benzo(g,h,i)perylene	< 8100	< 9800	1.5E+04	1.5E+04	4400	2500	1.8E+04	3.7E+04	1.6E+04	1.1E+04

Note: Blank indicates not detected.

"<" indicates detected less than the detection limit shown.

"E+" indicates base ten exponent.

Particle Size Results of Analysis



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

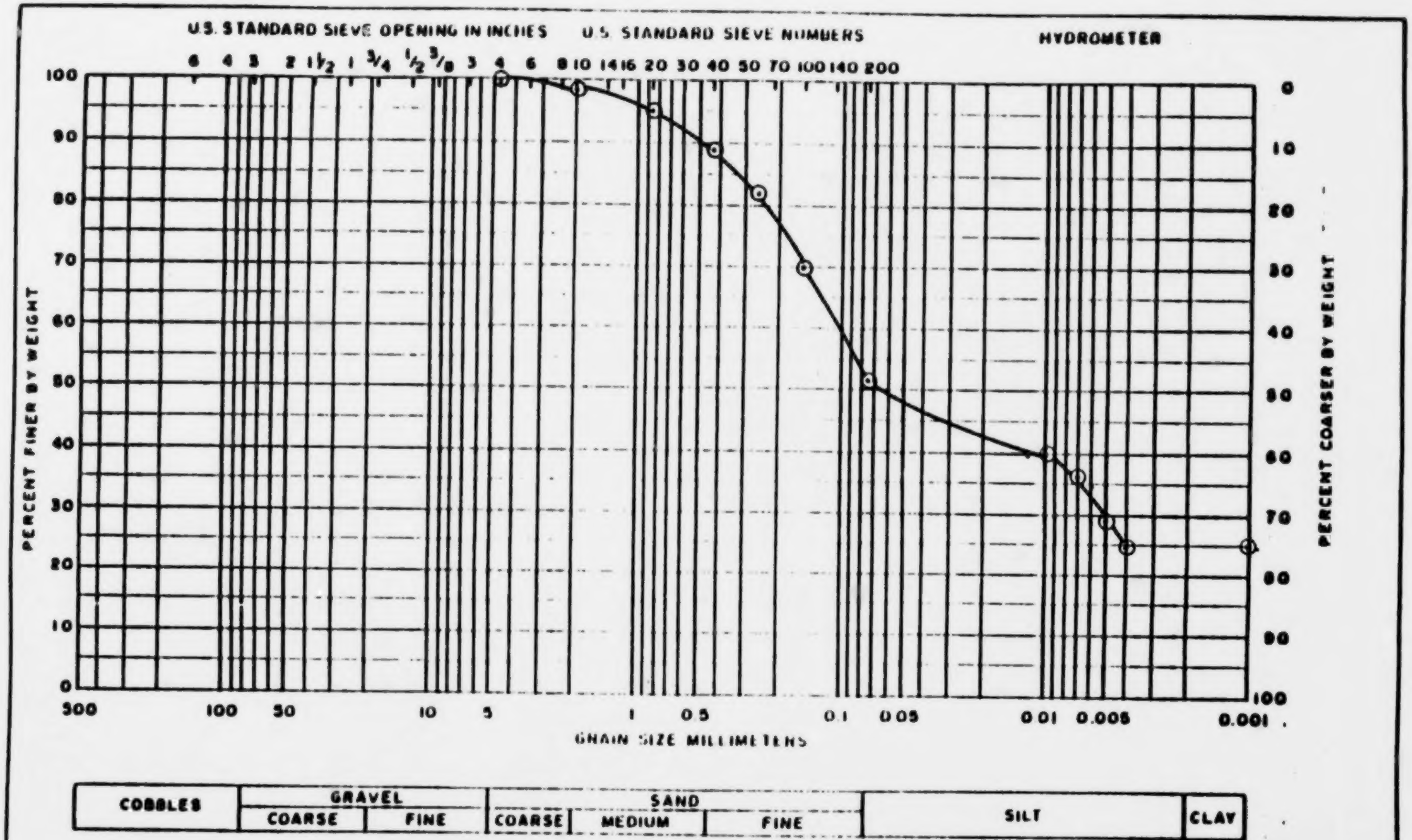
SAIC

L-9-1R

TESTED BY	CHECKED BY	PROJ. NO.
KM	GWC	5657-01
	DATE 1/17/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

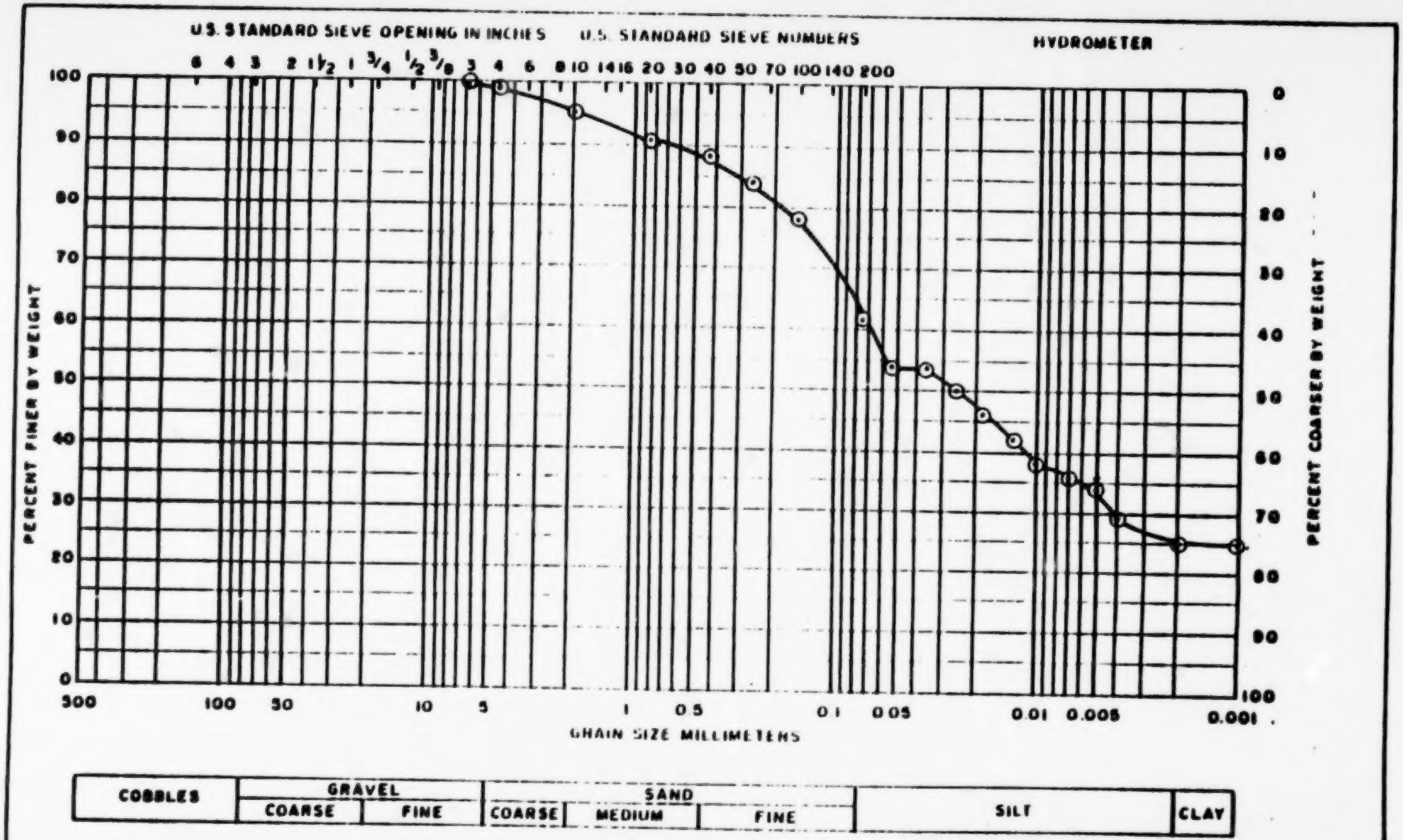
SAIC

J-7-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/17/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

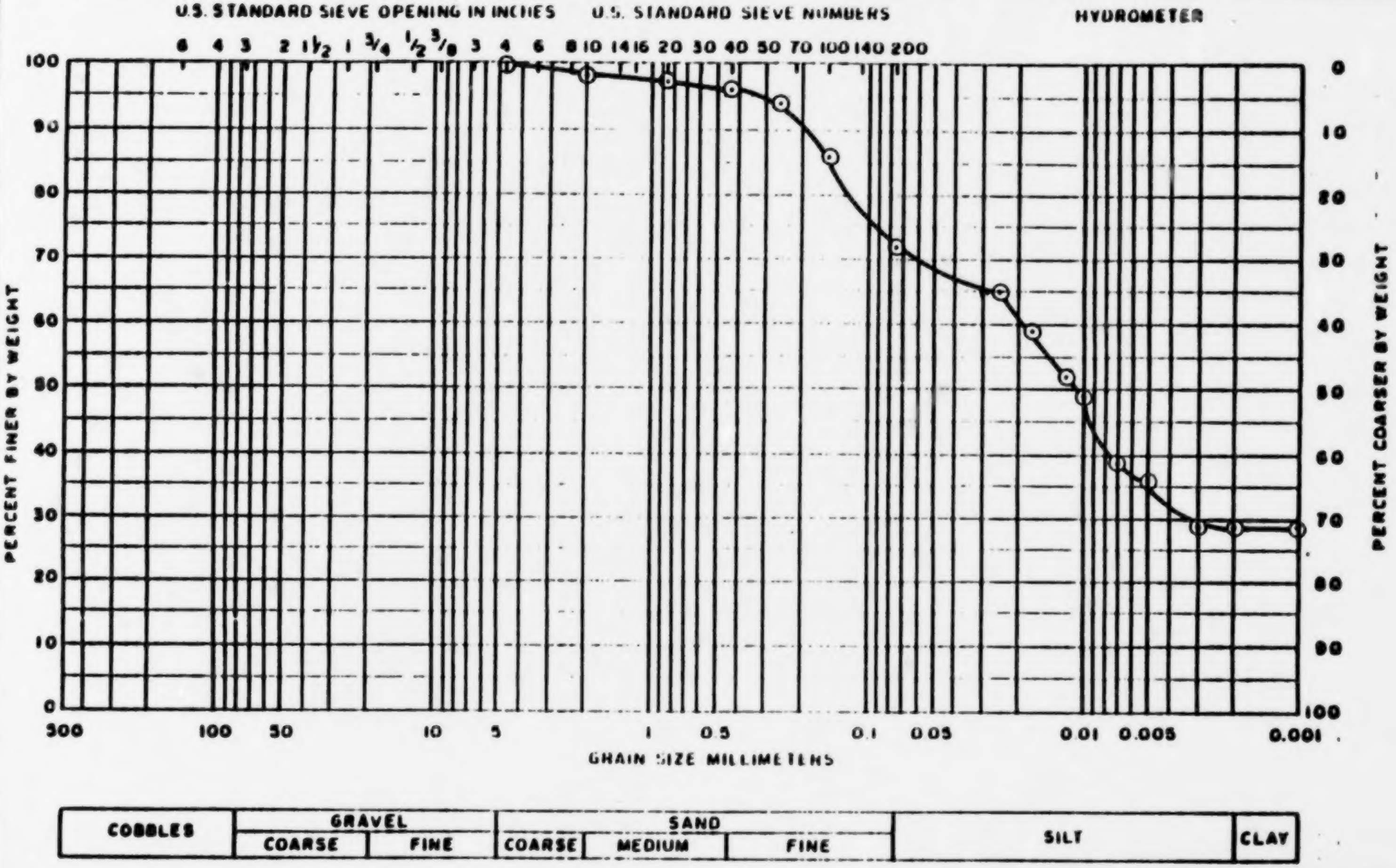
SAIC

I-11-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/7/09	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

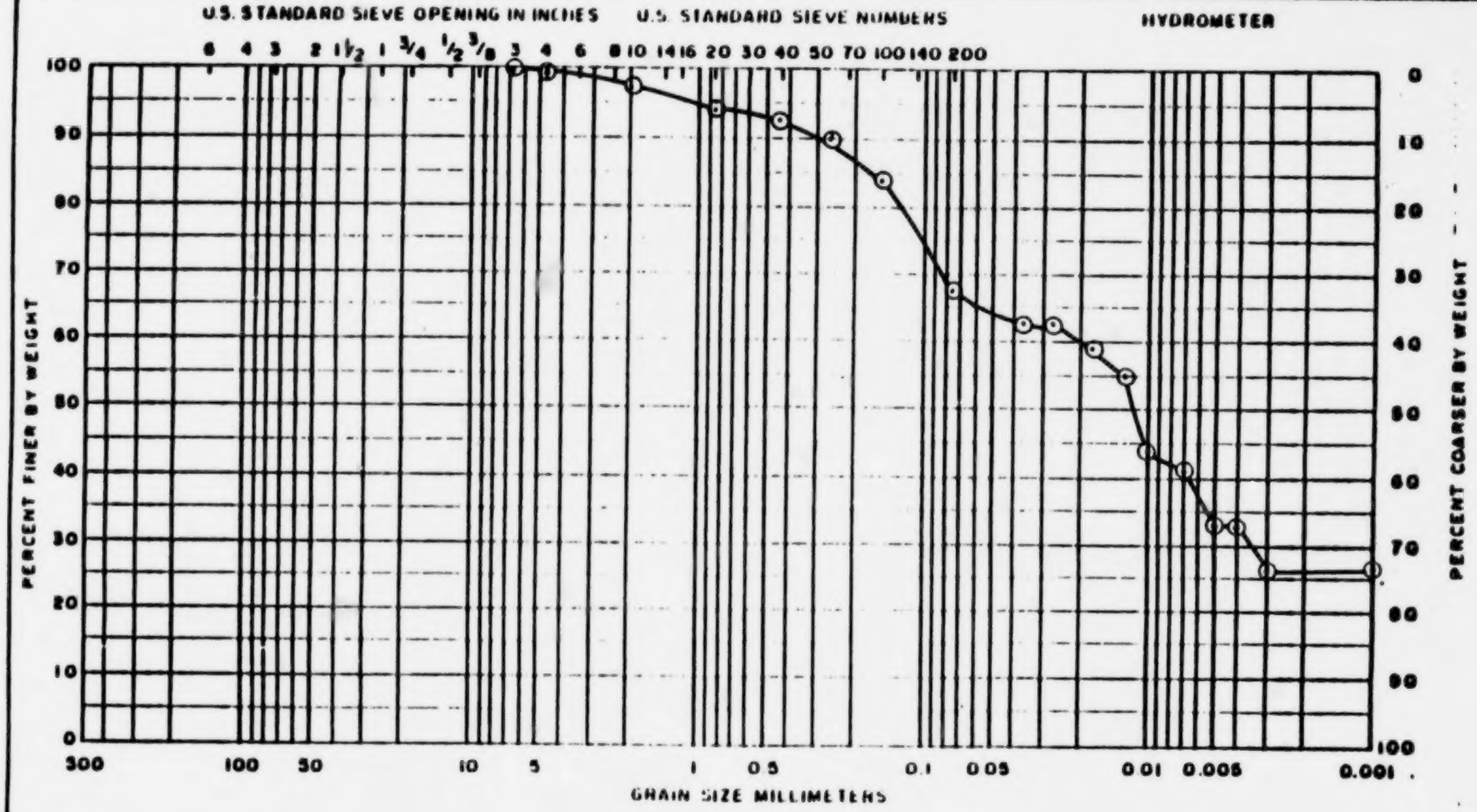
SAIC

H-20-2R

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 11/7/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



COBBLES	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

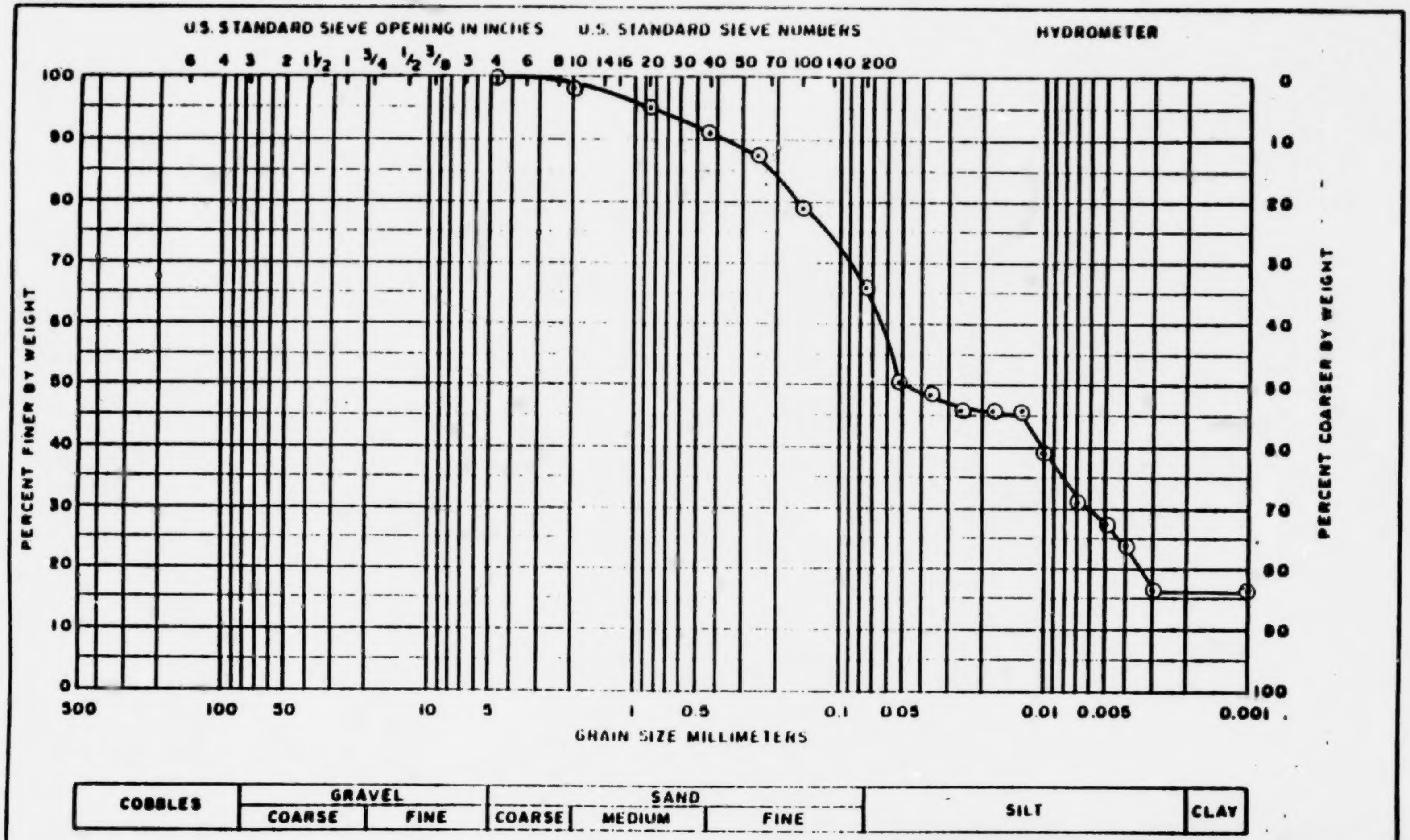
SAIC

H-22-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/13/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

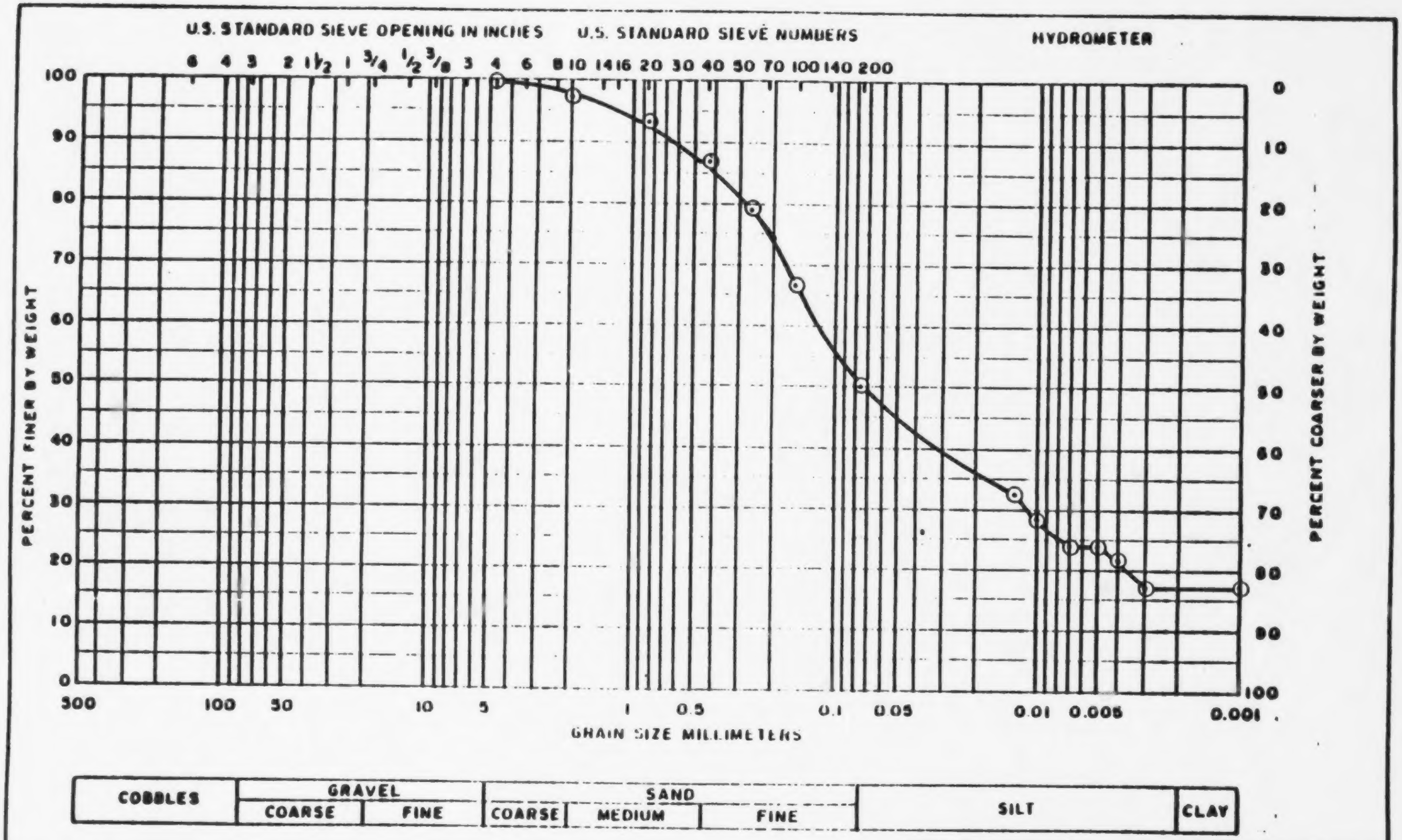
SAIC

H-21-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/13/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

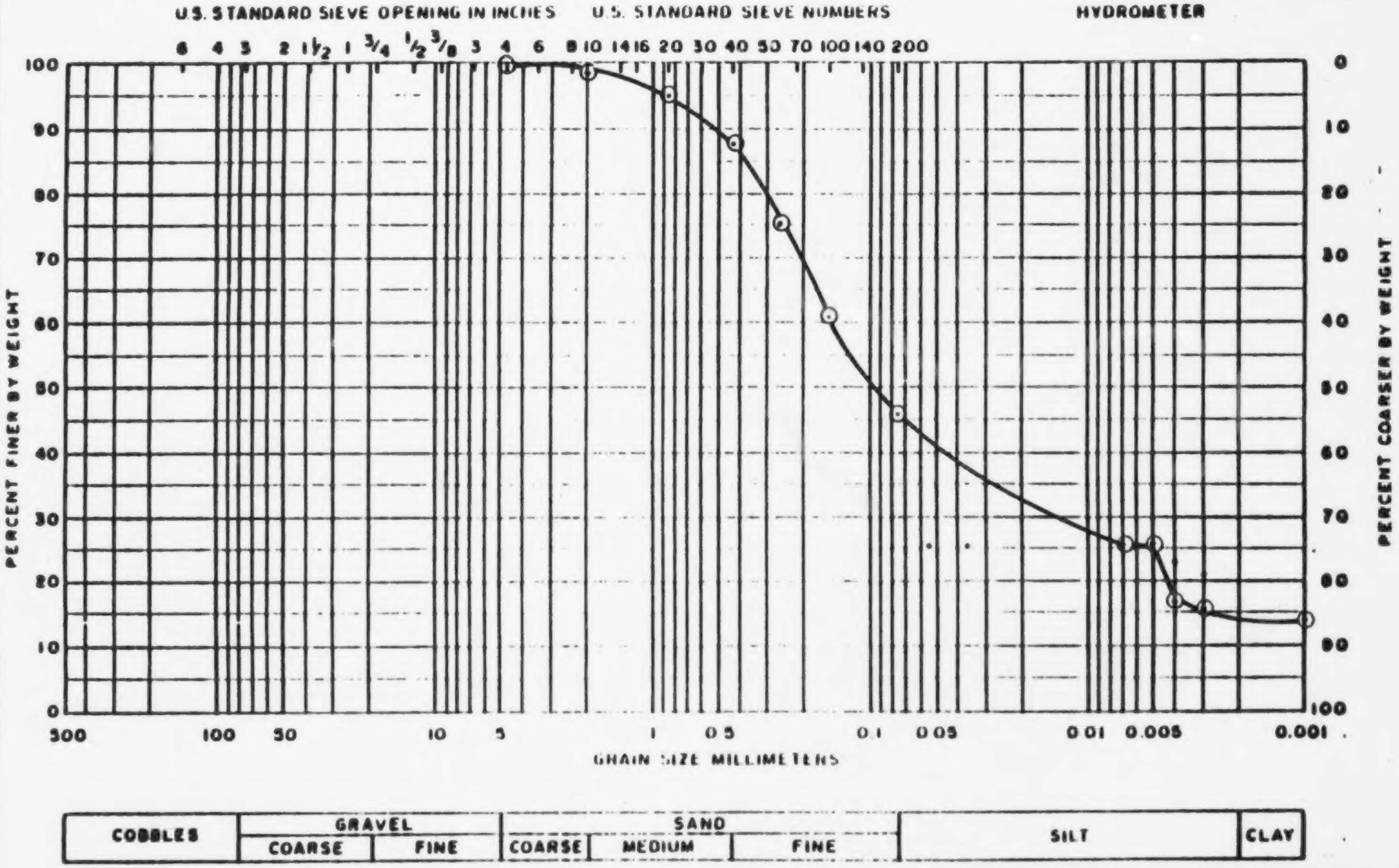
SAIC

H-23-2

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/13/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

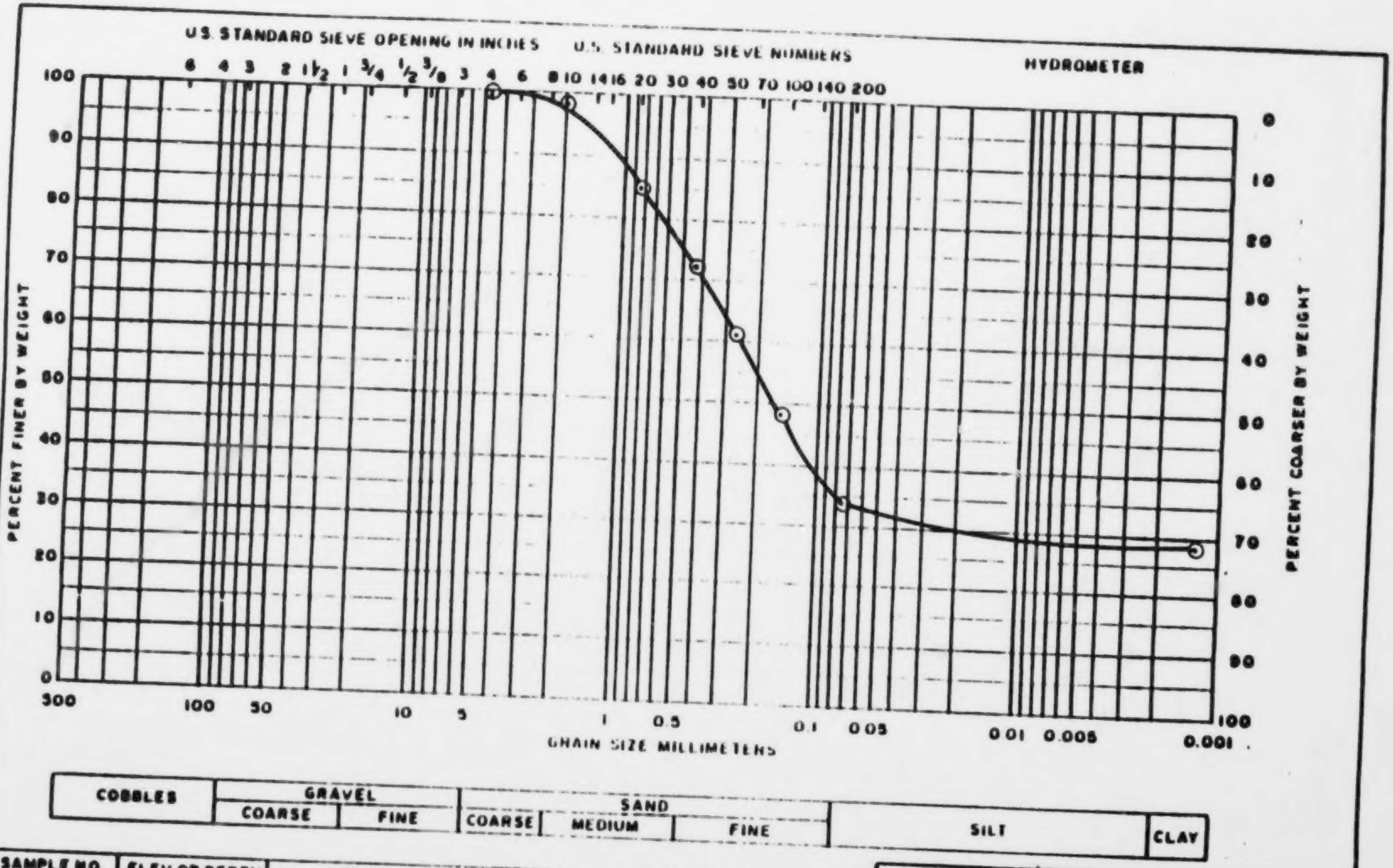
SAIC

L-B-2R

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/13/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

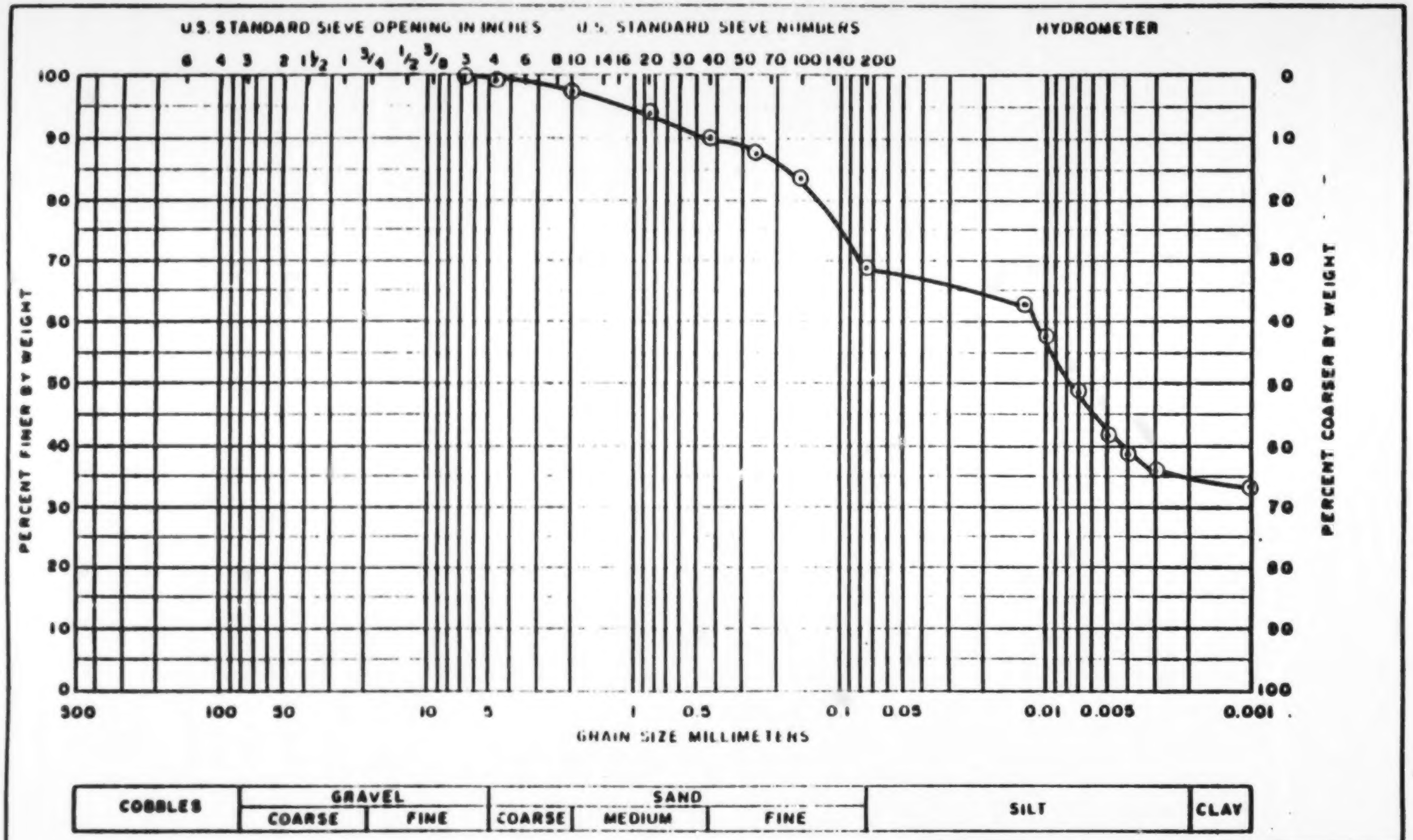
SAIC

J-7-2R

TESTED BY KM	CHECKED BY GWC	PROJ NO 5657-01
	DATE 1/11/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

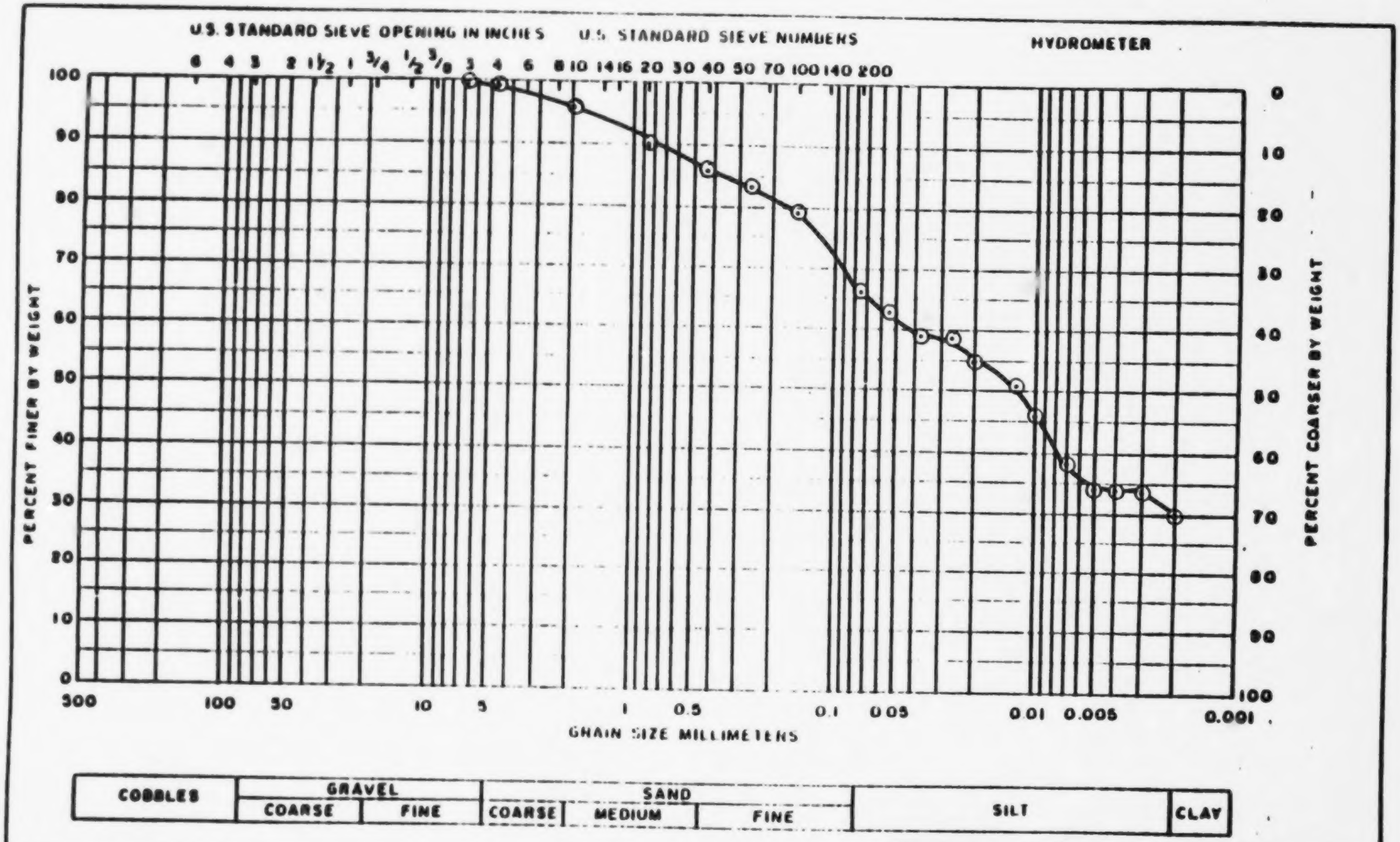
SAIC

H-22-2

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/11/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

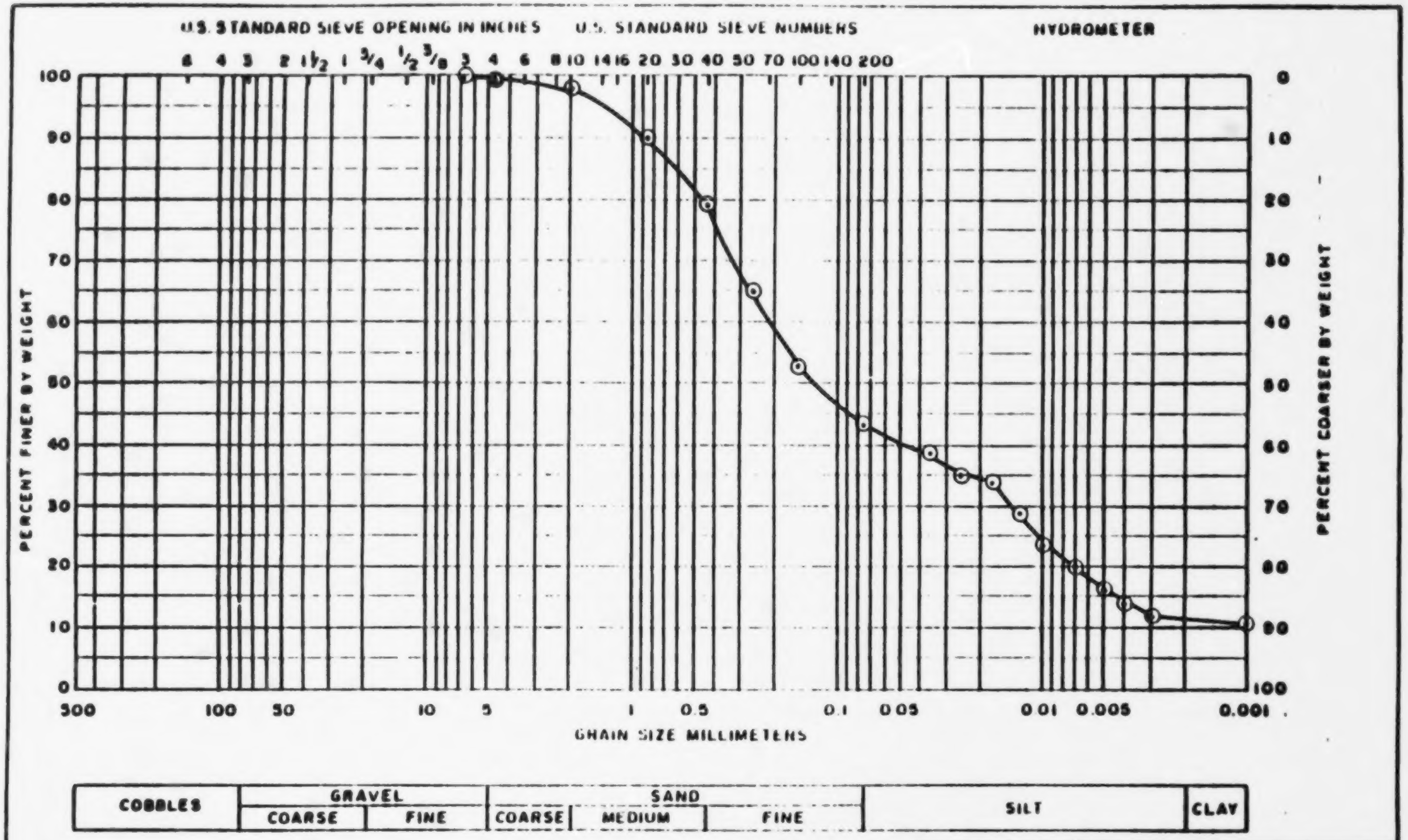
SAIC

I - 11 - 2R

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/11/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

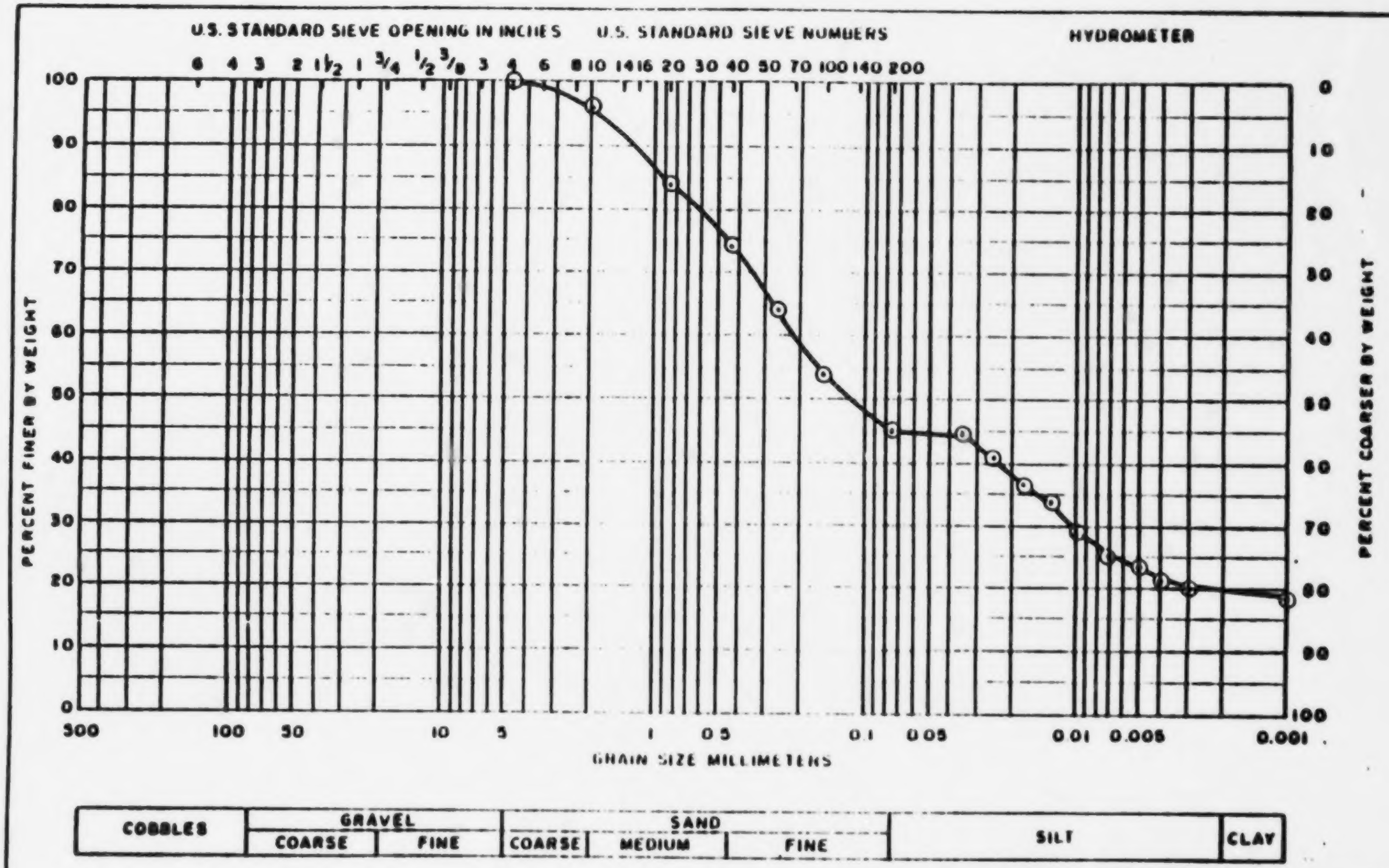
SAIC

L-7-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 1/11/89	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

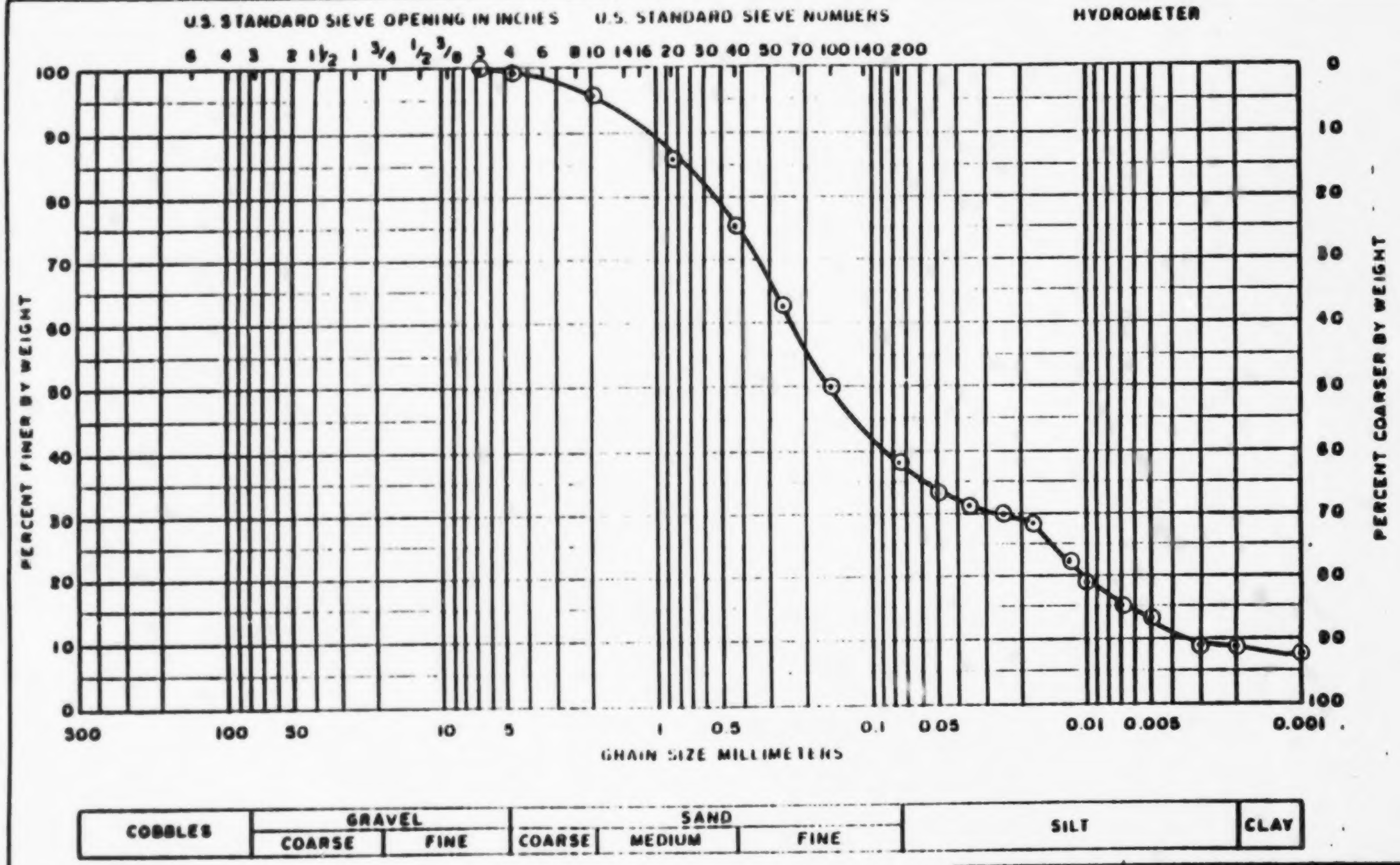
SAIC

L-9-2

TESTED BY KM	CHECKED BY GWC	PROJ NO 5657-01
	DATE 1/11/09	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

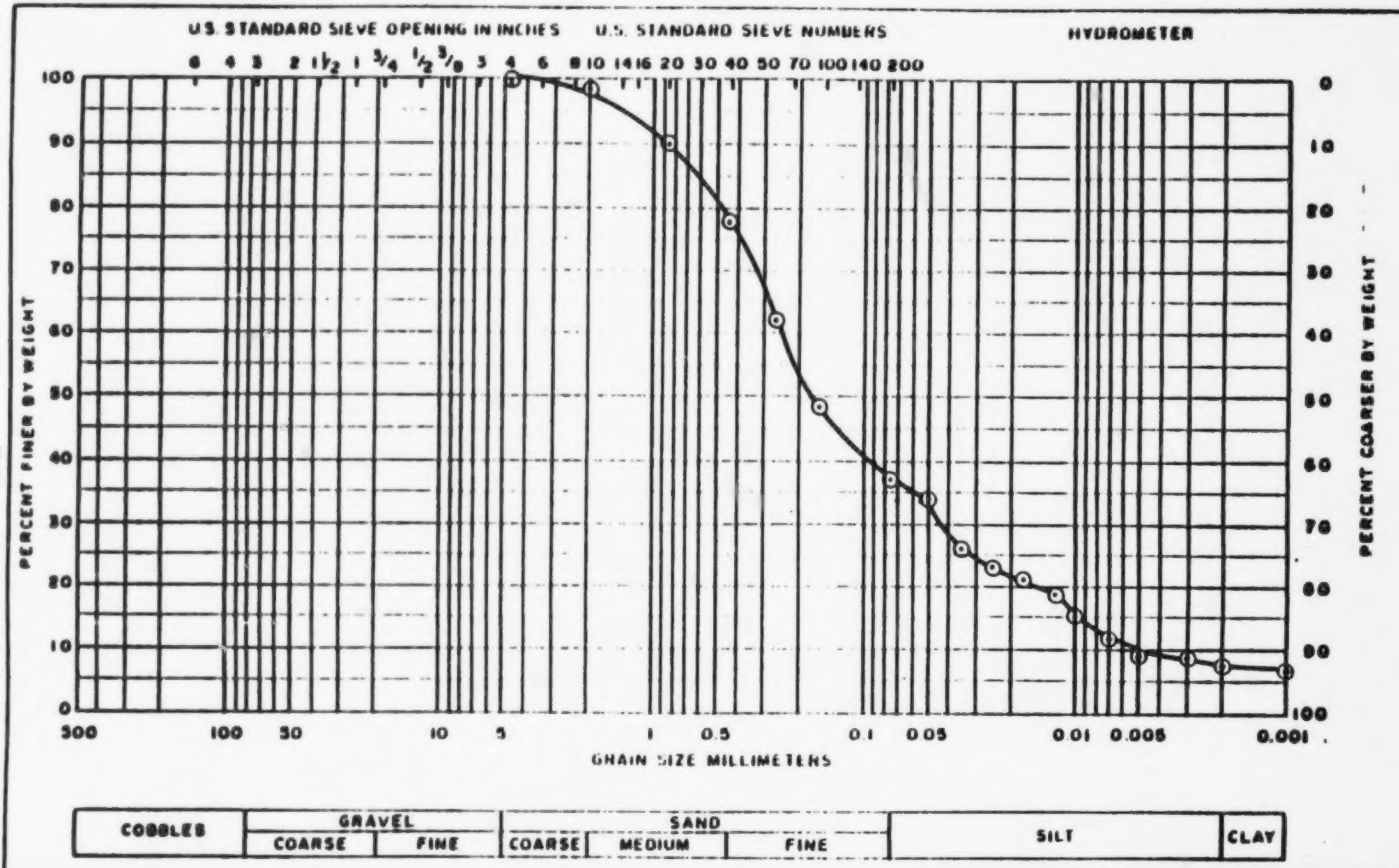
SAIC

L-B-1

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 10/18/88	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

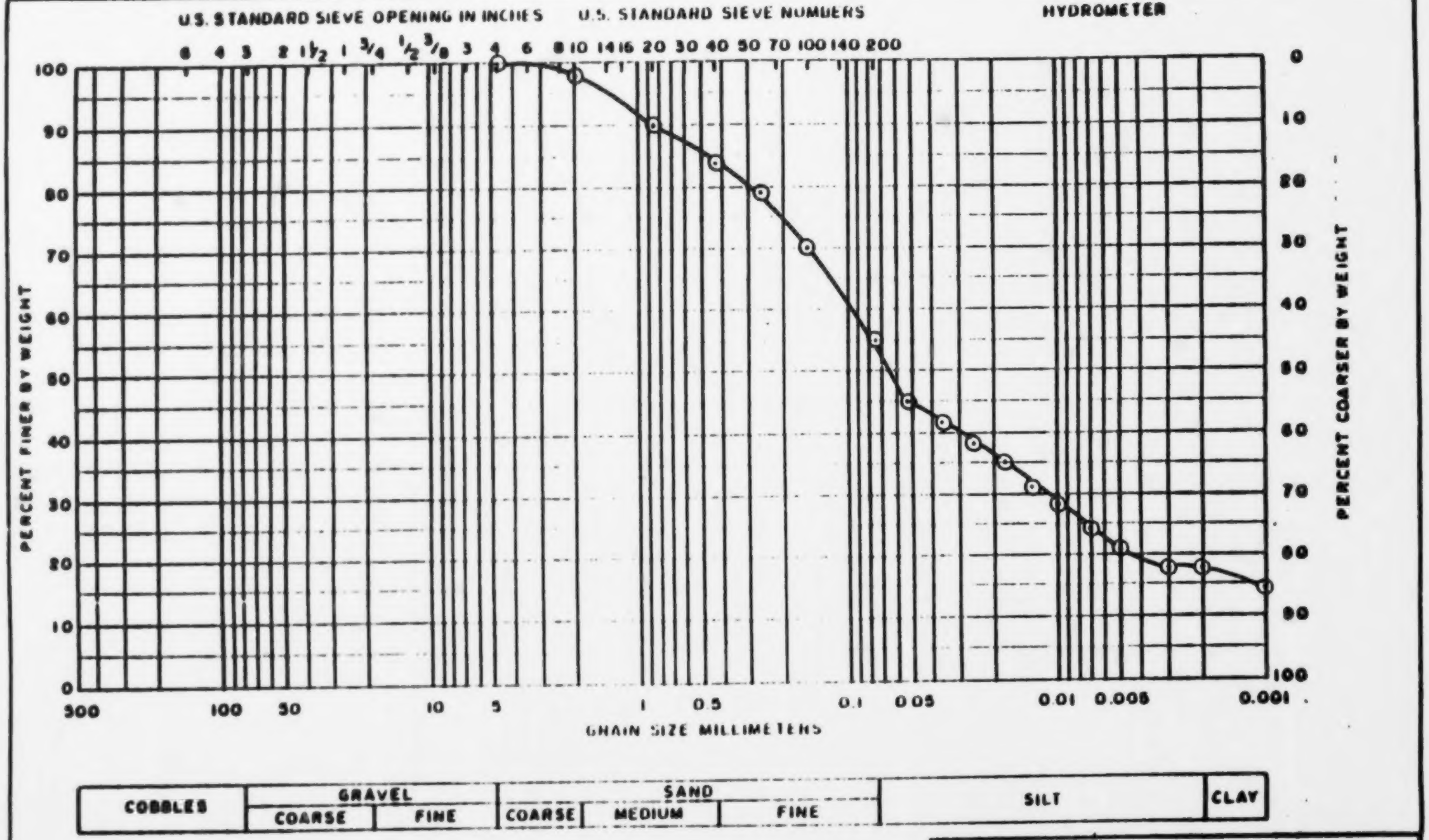
SAIC

L-7-2

TESTED BY KM
CHECKED BY GWC
PROJ NO 5657-01
DATE 10/10/88

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

SAIC

H - 20 - 1R

TESTED BY KM

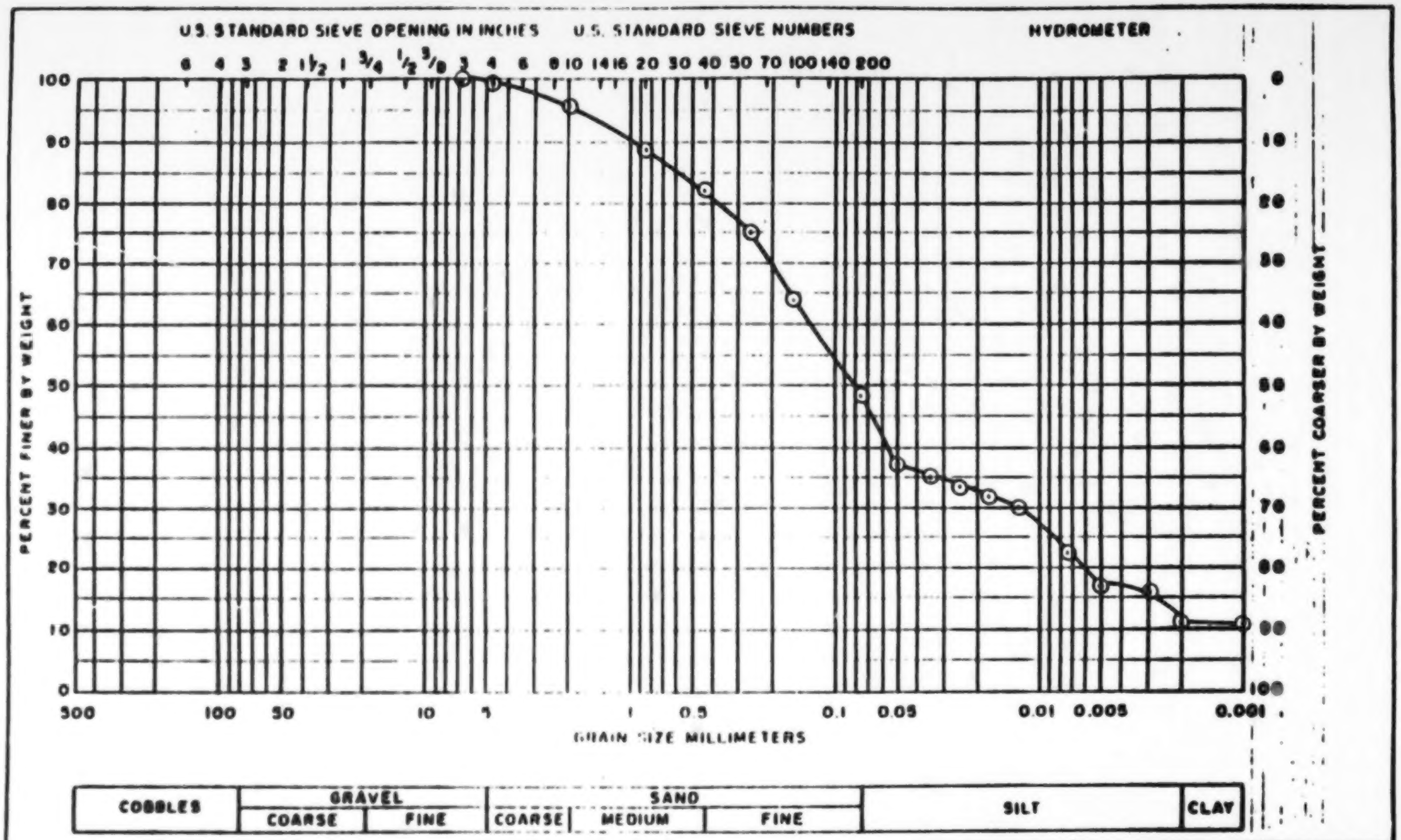
CHECKED BY GWC

DATE 10/18/88

PROJ NO 5657-01

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS

JGA 003
1 APR 82



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRAIN SIZE DISTRIBUTION CURVES

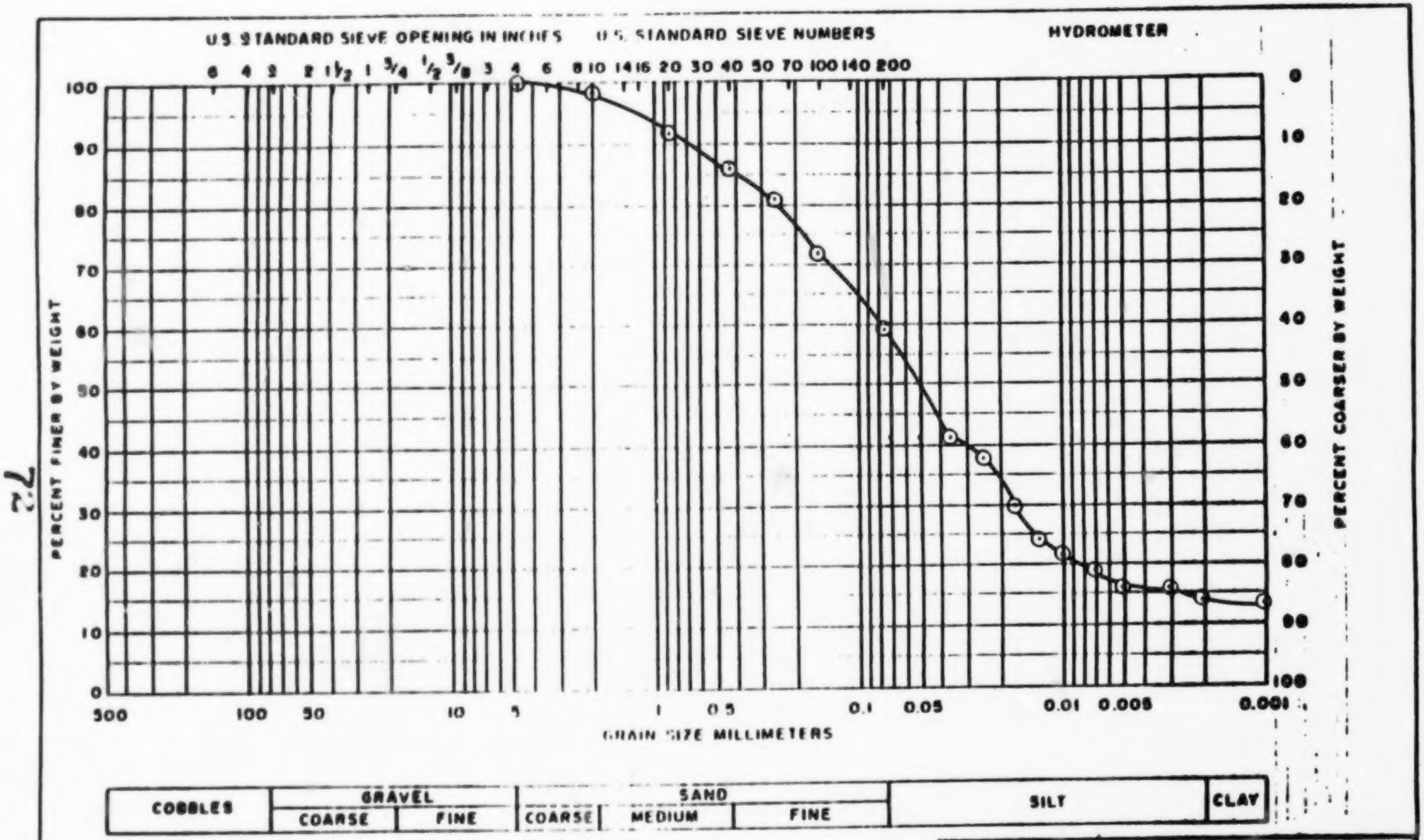
SAIC

H-23-2R

TESTED BY	CHECKED BY	PROJ NO
KM	GWC	5657-01
	DATE 10/18/88	

JGA 003
1 APR 82

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

JGA 003
1 APR 82

GRAIN SIZE DISTRIBUTION CURVES

SAIC

H-21-2

TESTED BY KM

CHECKED BY GWC

PROJ NO 5857-01

DATE 10/18/80

JORDAN GORRILL ASSOCIATES
GEOTECHNICAL CONSULTANTS

SAIC SITE PROGRAM

POLYCHLORINATED BIPHENYL ANALYSES

NEW BEDFORD HARBOR

Prepared For:

Science Applications International Corp.
8400 Westpark Drive
McLean, VA 22102

Prepared By:

Patrick W. Meehan
Radian Corporation
8501 MoPac Blvd.
P. O. Box 201088
Austin, TX 78720-1088

9 December 1988

TABLE OF CONTENTS

Page

1.0 OVERVIEW.. 1

2.0 SAMPLE DESCRIPTION.................................... 2

3.0 ANALYTICAL METHODOLOGY................................ 4

3.1 Extraction.. 4

3.2 Analysis.. 5

3.2.1 EPA Method 680 (GC/MS).............................. 5

3.2.2 EPA Method 8080 (GC/ECD)............................ 6

3.2.3 NIOSH Method P&CAM 253 (Perchlorination)............ 6

4.0 RESULTS AND DISCUSSION................................ 8

4.1 Phase One - Demo One (GC/MS).......................... 8

4.2 Phase Two - Demo 4, Pass 4............................ 21

4.2.1 Method 680 - GC/MS.................................. 21

4.2.2 Method 8080 - GC/ECD................................ 53

4.3 Phase Three - Florisil Tubes.......................... 53

4.4 Phase Four - Analysis of EC Jordan Sample Extract...... 57

4.4.1 Method 680 - GC/MS.................................. 57

4.4.2 Method 8080 - GC/ECD................................ 57

5.0 CONCLUSIONS... 66

Appendix A - Chain-of-Custody Records

Appendix B - GC/ECD Chromatograms and Raw Data

LIST OF TABLES

Table Page

2-1 SAIC SAMPLE DESCRIPTION AND CODING.......................... 3
4-1 SAIC PCB DATA BY ISOMER CLASS - DEMO 1..................... 15
4-2 SAIC MATRIX SPIKE/MATRIX SPIKE RECOVERY DATA................ 16
4-3 METHOD 680 DATA COMPARISON BY DRY WEIGHT 5-POINT CALIBRATION CURVE - DEMO 1................................ 17
4-4 SAIC SURROGATE RECOVERIES (%) - DEMO 1..................... 18
4-5 TENTATIVE IDENTIFICATION AND RELATIVE AMOUNTS OF AROCLORS - DEMO 1.. 19
4-6 METHOD 680 PCB ISOMER GROUP RATIO COMPARISONS 5-POINT CALIBRATION CURVE - DEMO 1................................ 20
4-7 SAIC PCB CONCENTRATION BY ISOMER CLASS - DEMO 4, PASS 4.....
4-8 SAIC MATRIX SPIKE/MATRIX RECOVERY DATA FOR.................. 49
DEMO 4, PASS 4 - GC/MS....................................... 50
4-9 FEED, RAFFINATE AND OIL CONGENER CLASS RATIOS FOR DEMO 4, PASS 4 - GC/MS... 51
4-10 SURROGATE % RECOVERIES FOR DEMO 4, PASS 4 - GC/MS.......... 52
4-11 TENTATIVE IDENTIFICATION AND RELATIVE AMOUNTS OF AROCLORS FOR DEMO 4, PASS 4 - GC/MS................................. 54
4-12 METHOD 680 ISOMER GROUP RATIO COMPARISONS FOR DEMO 4, PASS 4 - GC/MS...................................... 55
4-13 SAIC 8080 DATA IN ug/g BY AROCLOR (ASSUMING 100% AROCLOR 1242) FOR DEMO 4 GC/ECD............................ 56
4-14 SAIC FLORISIL TUBE DATA.................................... 58
4-15 EC JORDAN EXTRACT PCB CONCENTRATION BY ISOMER CLASS (ug/g).. 64
4-16 EC JORDAN SAMPLE EXTRACT 8080 DATA IN ug/g BY AROCLOR....... 65

LIST OF FIGURES

Figure Page

1 Total Ion Current Chromatogram for SAIC Feed Sample......... 9
2 Extracted Ion Current Profile Chromatograms for SAIC Feed Sample.. 10
3 Total Ion Current Chromatogram for SAIC Raffinate Sample.... 11
4 Extracted Ion Current Profile Chromatograms for SAIC Raffinate Sample.. 12
5 Total Ion Current Chromatogram for SAIC Reagent Blank....... 13
6 Extracted Ion Current Profile Chromatograms for SAIC Reagent Blank.. 14
7 Total Ion Current (TIC) Chromatogram of Blanks and 5 ppm Standard.. 22
8 TICs of Duplicate Feed and Raffinate Matrix Spike/Matrix Spike Duplicate Samples................................. 23
9 TICs of Duplicate Raffinate and Oil Samples................ 24
10 Extracted Ion Current Profiles (EICPs) for Mono- Through Penta- Isomers of 5 ppm Standard........................... 25
11 EICPs of Hexa- Through Deca- Isomers of 5 ppm Standard...... 26
12 EICPs of Mono- Through Penta- Isomers of Feed Sample........ 27
13 EICPs of Hexa- Through Deca- Isomers of Feed Sample......... 28
14 EICPs of Mono- Through Penta- Isomers of Duplicate Feed Sample.. 29
15 EICPs of Hexa- Through Deca- Isomers of Duplicate Feed Sample.. 30
16 EICPs of Mono- Through Penta- Isomers of Raffinate Sample... 31
17 EICPs of Hexa- Through Deca- Isomers of Raffinate Sample.... 32
18 EICPs of Mono- Through Penta- Isomers of Duplicate Raffinate Sample... 33
19 EICPs of Hexa- Through Deca- Isomers of Duplicate Raffinate Sample... 34
20 EICPs of Mono- Through Penta- Isomers of Raffinate Matrix Spike Sample.. 35
21 EICPs of Hexa- Through Deca- Isomers of Raffinate Matrix Spike Sample.. 36

LIST OF FIGURES (Continued)

		Page
22	EICPs of Mono- Through Penta- Isomers of Raffinate Matrix Spike Duplicate Sample	37
23	EICPs of Hexa- Through Deca- Isomers of Raffinate Matrix Spike Duplicate Sample	38
24	EICPs of Mono- Through Penta- Isomers of Extract Oil Sample.	39
25	EICPs of Hexa- Through Deca- Isomers of Extract Oil Sample..	40
26	EICPs of Mono- Through Penta- Isomers of Duplicate Extract Oil Sample	41
27	EICPs of Hexa- Through Deca- Isomers of Duplicate Extract Oil Sample	42
28	EICPs of Mono- Through Penta- Isomers of Reagent Blank	43
29	EICPs of Hexa- Through Deca- Isomers of Reagent Blank	44
30	EICPs of Mono- Through Penta- Isomers of Reagent Blank #2	45
31	EICPs of Hexa- Through Deca- Isomers of Reagent Blank #2	46
32	EICPs of Mono- Through Penta- Isomers of Reagent Blank #3	47
33	EICPs of Hexa- Through Deca- Isomers of Reagent Blank #3	48
34	TIC of EC Jordan Sample Extract, With and Without Acid Clean-up	59
35	EICPs of Mono- Through Penta- Isomers of EC Jordan Extract, Untreated	60
36	EICPs of Hexa- Through Deca- Isomers of EC Jordan Extract, Untreated	61
37	EICPs of Mono- Through Penta- Isomers of EC Jordan Extract, Acid Washed	62
38	EICPs of Hexa- Through Deca- Isomers of EC Jordan Extract, Acid Washed	63

1.0 OVERVIEW

This report contains the results of the analysis of feed, raffinate, extract oil, and Florisil tube samples from the SITE Program from New Bedford Harbor, Work Assignment #0-9 for EPA Contract No. 68-03-3485. These samples were examined to determine if detectable levels of polychlorinated biphenyls (PCBs) could be found. These data were obtained by employing EPA Method 8080, gas chromatography/electron capture detection (GC/ECD); EPA Method 680, gas chromatography/mass spectrometry in the multiple ion detection mode (GC/MS--MID); and NIOSH Method P&CAM 253, GC/ECD with perchlorination to decachlorobiphenyl. This project was performed under four main sections. The first phase involved the GC/MS analysis of samples obtained for the Demo 1, Pass 1 test. In this experiment, PCBs were not found in the extract oil. It would appear that they were retained in the liquid propane extractor. The second phase involved the analysis of samples from Demo 4, Pass 4. In this phase of the demonstration, all of the samples were extracted and analyzed in duplicate by both Methods 680 and 8080. In third phase of this project, sorbent tubes were extracted and analyzed to determine if detectable levels of PCBs could be detected. These tubes contained Florisil that had been exposed to the air over the collection bins of the extract oil. The final phase of this project involved the analysis of the feed sample from Demo 4 that had been extracted by EC Jordan Co. This extract was split and one half was subjected to an acid wash cleaning while the remaining half was left as received. Each fraction of the EC Jordan extract was analyzed by both GC/ECD and GC/MS.

2.0 SAMPLE DESCRIPTION

The sample coding can be found in Table 2-1. The samples were accompanied by chain-of-custody records which were signed by the sample custodian upon inspection of the samples. The feed, raffinate and extract oil samples were received cold but all three of the extract oil samples had some leakage. The oil spills from both of the Demo 1 samples were contained by the secondary container but the spill from Demo 4, Pass 4 oil sample contaminated the ice chest. The sample extract from EC Jordan as well as all of the Florisil tubes were received at ambient temperature. All samples were logged in and transferred to a secured facility for storage. Copies of the chain-of-custody records are provided under separate cover as Appendix A.

TABLE 2-1. SAIC SAMPLE DESCRIPTION AND CODING

Sample Description		Radian Sample Number		Matrix	Date Sampled	Date Received	Volume Sampled
		Mass Spec	GC/ECD				
DEMO ONE							
FK-1	DEMO 1	A809029-01	—	Feed	9/02/88	9/07/88	NA
FK-1R	DEMO 1	Duplicates Mixed		Feed	9/02/88	9/07/88	NA
RPT-1	DEMO 1	A809029-02A	—	Raffinate	9/03/88	9/07/88	NA
RPT-1R	DEMO 1	Duplicates Mixed		Raffinate	9/03/88	9/07/88	NA
	Matrix Spike	A809029-02B MS	—	Raffinate	9/03/88	9/07/88	NA
	Matrix Spike Dup.	A809029-02C MSD	—	Raffinate	9/03/88	9/07/88	NA
EPT-1	DEMO 1	A809029-03	—	Extract Oil	9/06/88	9/07/88	NA
EPT-1R	DEMO 1	Duplicates Mixed		Extract Oil	9/06/88	9/07/88	NA
	Reagent Blank	A809029-RBS	—	Reagent Blank	NA	NA	NA
DEMO FOUR							
RPT-1	ECJ S/N 8273003	A810035-01A	A810035-01E	Raffinate	9/23/88	10/10/88	NA
		A810035-01B-DUP	A810035-01F-DUP	Raffinate	9/23/88	10/10/88	NA
	Matrix Spike	A810035-01D-S	A810035-01G-S	Raffinate	9/23/88	10/10/88	NA
	Matrix Spike Dup.	A810035-01G-S	A810035-01H-S	Raffinate	9/23/88	10/10/88	NA
EPT-1	ECJ S/N 8273004	A810035-02A	A810035-02C	Extract Oil	9/23/88	10/10/88	NA
		A810035-02B-D	A810035-02D-D	Extract Oil	9/23/88	10/10/88	NA
FK-1	ECJ S/N 8273005	A810035-03A	A810035-03C	Feed	9/22/88	10/10/88	NA
		A810035-03B-D	A810035-03D-D	Feed	9/22/88	10/10/88	NA
	Reagent Blank	A810035-03E-B	A810035-RB	Reagent Blank	NA	NA	NA
	Reagent Blank	A810035-RBDMS	A810035-RB	Reagent Blank	NA	NA	NA
	Reagent Blank	A810035-RBMS	A810035-RB	Reagent Blank	NA	NA	NA
	5.0 ppm PCB Stnd.	5.0 ppm Stnd	—	5.0 ppm Stnd	NA		
EC Jordan Extract DEMO 4							
ECJ Extract	ECJ S/N 8265059	A810079-01A	A810079-01B	Hexane	9/22/88	10/21/88	360 microLiters
	Demo 4 Pass 1 FK-1	A810079-02A	A810079-02B	Acid Washed C6			360 microLiters
Florisil Tubes							
HIRAF-01	Raff-Test 4 Pass 1	—	A809093-01A	Florisil	9/21/88	9/23/88	5.179 Liters
HIRAF-02	Raff-Test 4 Pass 2	—	A809093-02A	Florisil	9/21/88	9/23/88	12.494 Liters
HIRAF-03	Raff-Test 4 Pass 3	—	A809093-03A	Florisil	9/21/88	9/23/88	45.947 Liters
HIRAF-04	Raff-Test 4 Pass 4	—	A809093-04A	Florisil	9/22/88	9/23/88	40.641 Liters
BLANK	Blank	—	A809093-05A	Florisil	9/22/88	9/23/88	0 Liters
F923-A1	Raffinate Test	—	A809099-01A	Florisil	9/23/88	9/26/88	24.2 Liters
F923-A2	Extract Test	—	A809099-02A	Florisil	9/23/88	9/26/88	0.6 Liters
F923-01	Site Test	—	A809099-03A	Florisil	9/23/88	9/26/88	0 Liters
EPT-1	WDE 0988-010	—	A810016-01A	Florisil	9/29/88	10/05/88	Vol Not Provided
RPT-1	WDE 0988-011	—	A810016-02A	Florisil	9/29/88	10/05/88	Vol Not Provided
EPT-1	F923P1	—	A810016-03A	Florisil	9/23/88	10/05/88	Vol Not Provided
RPT-1	T927-01	—	A810016-04A	Florisil	9/27/88	10/05/88	Vol Not Provided
RPT-1	T928-A1	—	A810016-05A	Florisil	9/28/88	10/05/88	Vol Not Provided
BLANK	Matrix Spike	—	A810038-01A	Florisil	N/A	10/10/88	0 Liters
BLANK	Matrix Spike Dup.	—	A810038-02A	Florisil	N/A	10/10/88	0 Liters
BLANK	Blank	—	A810038-03A	Florisil	10/09/88	10/10/88	0 Liters

NA = Not Applicable

3.0 ANALYTICAL METHODOLOGY

3.1 Extraction

Due to the high level of PCBs expected in the Demo 1 samples, some modifications were made to the extraction method suggested in the third edition of SW-846. The surrogates that are used at the Radian Laboratories for Method 680 analyses are ^{13}C-labelled PCBs. This choice of surrogates would appear to be far superior to the pesticides that are recommended in the GC/MS method. However, it becomes cost prohibitive to add enough surrogate standards to the matrix when there are high levels of PCBs present. If a representative sample size is chosen, then the sample extract must be diluted to bring the analytes into the calibration range of the instrument. This puts the surrogates at a concentration that is below the detection limit. To alleviate this problem, the high level samples were first diluted in acetone, and then an aliquot was removed and spiked with the ^{13}C-labelled surrogates. Acetone was chosen as the dilution solvent since it could mix with any water in the sample, yet still dissolve any oil and other organics that were present. The acetone/sample mixture was thoroughly shaken before the aliquot was removed to insure a representative sampling of the suspended particles.

In an attempt to obtain a representative aliquot of the sediment samples that contained high levels of PCBs, the sample jar was vigorously shaken and a portion of the sample was removed from the center of the jar with a pipette that has a 2 mm opening. The sample was removed before the particulate matter could settle out.

When the estimated concentration of PCBs in the sample was expected to be at a level within the calibration range of the mass spectrometer, the water was removed from the sample aliquot with sodium sulfate and the sample was extracted by Method 3550 (ultrasonic). The extract oil samples were prepared by Method 3580 (waste dilution).

A full scan mass spectral analysis of the extract of the oil sample from Demo 1 revealed that there were exceptionally high levels of polycyclic aromatic hydrocarbons (PAHs) present in the sample. These compounds were interfering with the analysis of the PCBs due to source suppression. This phenomenon occurs whenever there is a large concentration of any other compound in the source at the same time the analytes of interest are present. The finite number of electrons that are available in the source for ionization are depleted, resulting in a reduction in the ionization of the analyte of interest. Consequently, subsequent extractions involved the use of sulfuric acid to remove most of the interfering compounds. (This acid wash is described in "The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oils," EPA-600/4-81-045, U.S. EPA, September, 1982.) The use of this acid wash is further supported by the good surrogate recoveries that were obtained by both Methods 680 and 8080.

3.2 Analysis

3.2.1 EPA Method 680 (GC/MS)

The concentrations of PCBs described in the results section of this report for GC/MS were calculated according to EPA Method 680 (Nov. 1985). The only significant variation from the method was in the use of the ^{13}C-labelled surrogates as previously discussed. All values are reported as the concentrations of each congener group. That is, the amount of monochlorobiphenyls is reported as total of all three isomers. The amount of dichlorobiphenyl is reported as the sum total of all 12 possible dichloro-isomers. By reporting the PCB concentrations by isomer group, we avoid the need to have the Aroclor pattern (that is necessary for quantitation by Method 8080). Even if the Aroclor pattern is chemically altered, Method 680 will still afford the proper quantitation of the polychlorinated biphenyls.

3.2.2 EPA Method 8080 (GC/ECD)

The Aroclor concentrations described in the results section of this report for GC/ECD were calculated according the EPA Method 8080 (SW-846, Third Edition). The only significant deviation from this method is the use of two columns, a SPB-5 primary column and a DB-17 megabore column as a secondary column. By having two columns and detectors, the necessity of having a second column conformation analysis is eliminated. The injected sample is split between the two columns and both analyses are run simultaneously.

3.2.3 NIOSH Method P&CAM 253 (Perchlorination)

The levels of PCBs detected in the Florisil tubes collected over the extract oil drums, were determined by using NIOSH Method P&CAM 253 with the following variations:

- Method P&CAM 253 requires that a new standard curve be generated on each day of analyses. Radian analyzes a midpoint check standard at the beginning of each 12 hour analytical day which must agree within ±15 percent of the previously established average response factor, or the instrument is recalibrated. This approach is defined in our QAPP and is the same as standard EPA Method 8080.

- Although this method does not require the use of any surrogates to determine the extraction and analysis efficiencies, most of the Florisil tubes included the use of both dibutylchlorendate (DBC) and 2,4,5,6-tetrachloro-m-xylene (TCMX).

- These analyses also included the analysis of a matrix spike and matrix spike duplicate. This additional QA is also described in the QAPP.

- Method P&CAM states that the hexane should not be allowed to go to dryness during the chloroform exchange of the perchlorination procedure. The first time these samples were analyzed, the hexane that remained caused several analytical interference problems. In the final analysis, the samples were brought just to dryness, and then immediately removed from the bath.

- The final sample was concentrated from the recommended 10 mL to 1 mL to bring the concentration into the calibration range of the instrument.

4.0 RESULTS AND DISCUSSION

4.1 Phase One - Demo One (GC/MS)

The extracted ion current profile (EICP) chromatograms for the major ion of each isomer class, dichlorobiphenyl through hexachlorobiphenyl, and the total ion current (TIC) chromatograms for the samples are included as Figures 1 through 6. Figures 1 and 2 are the TIC and EICP, respectively, for the feed sample. Figures 3 and 4 are the raffinate sample, while Figures 5 and 6 are from the reagent blank. Table 4-1 lists the amount of PCBs found in each sample by isomer class (for both wet and dry weights). These data are calculated on a five-point calibration curve, using the isomers recommended in Method 680 to obtain the response factors. The matrix spike/matrix spike duplicate (MS/MSD) data are presented in Table 4-2. Table 4-3 is the data comparison of the feed and raffinate samples based on a dry weight determination. The feed sample was 26% solids and the raffinate sample was 1.89% solids. According to these determinations, the liquid propane removed 70% of the total PCBs that were present in the feed. The percent recoveries of the ^{13}C-labelled surrogates are given in Table 4-4. The values for the oil sample listed on Tables 4-1 and 4-4 are estimates based on the average response of the internal standard (IS) for the date of the analyses. Interferents in the sample masked the recovery of the IS, making the estimation necessary.

Table 4-5 is a listing of the tentative identification and the relative percentages of the Aroclors present in these samples. These data were obtained by using a computer program developed by L.E. Slivon at Battelle[1] for Ann Alford-Stevens (at EMSL). Since it is apparent from the large relative percent differences in Table 4-6, the isomer group ratio comparisons, and the feed to raffinate ratios from Table 4-3, that the lower

---

[1] Lawrence E. Slivon - Battelle Columbus Division Aroclor - A Computer Program for the Estimation of Aroclor Content from GC/MS Level of Chlorination Data - Version 2.4, July 26, 1988, for Ann Alford-Stevens Environmental Monitoring and Support Laboratory.

3D

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Jordan Contract: 68-W8-0032

Lab Code: Jordan Case No.: SAIC 8236 SAS No.: ______ SDG No.: ______

Matrix Spike - EPA Sample No.: Drum I-11-2 DL Level:(low/med) Low

(8236-008 DL)

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Phenol	22,220	0	18149	82	26- 90
2-Chlorophenol	22,220	0	21636	97	25-102
1,4-Dichlorobenzene	11,110	436436	175852	--*	28-104
N-Nitroso-di-n-prop.(1)	11,110	0	7901	71	41-126
1,2,4-Trichlorobenzene	11,110	0	22848	206*	38-107
4-Chloro-3-methylphenol	22,220	0	17069	77	26-103
Acenaphthene	11,110	0	11702	105	31-137
4-Nitrophenol	22,220	0	8694	39	11-114
2,4-Dinitrotoluene	11,110	0	3545	32	28- 89
Pentachlorophenol	22,220	0	0	0*	17-109
Pyrene	11,110	9873	36932	244*	35-142

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol	22,220	25,096	113*	32	35	26- 90
2-Chlorophenol	22,220	23,720	107*	9	50	25-102
1,4-Dichlorobenzene	11,110	189087	--*	--*	27	28-104
N-Nitroso-di-n-prop.(1)	11,110	13440	121	52*	38	41-126
1,2,4-Trichlorobenzene	11,110	26409	238*	14	23	38-107
4-Chloro-3-methylphenol	22,220	21251	96	22	33	26-103
Acenaphthene	11,110	17373	156*	39*	19	31-137
4-Nitrophenol	22,220	29188	131*	108*	50	11-114
2,4-Dinitrotoluene	11,110	8160	73	79*	47	28- 89
Pentachlorophenol	22,220	0	0*	0	47	17-109
Pyrene	11,110	23046	119	69*	36	35-142

(1) N-Nitroso-di-n-propylamine

# Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 6 out of 11 outside limits
Spike Recovery: 11 out of 22 outside limits

COMMENTS: Sample concentration of 1,4-Dichlorobenzene was much higher than that in either MS or MSD due to matrix interferences.

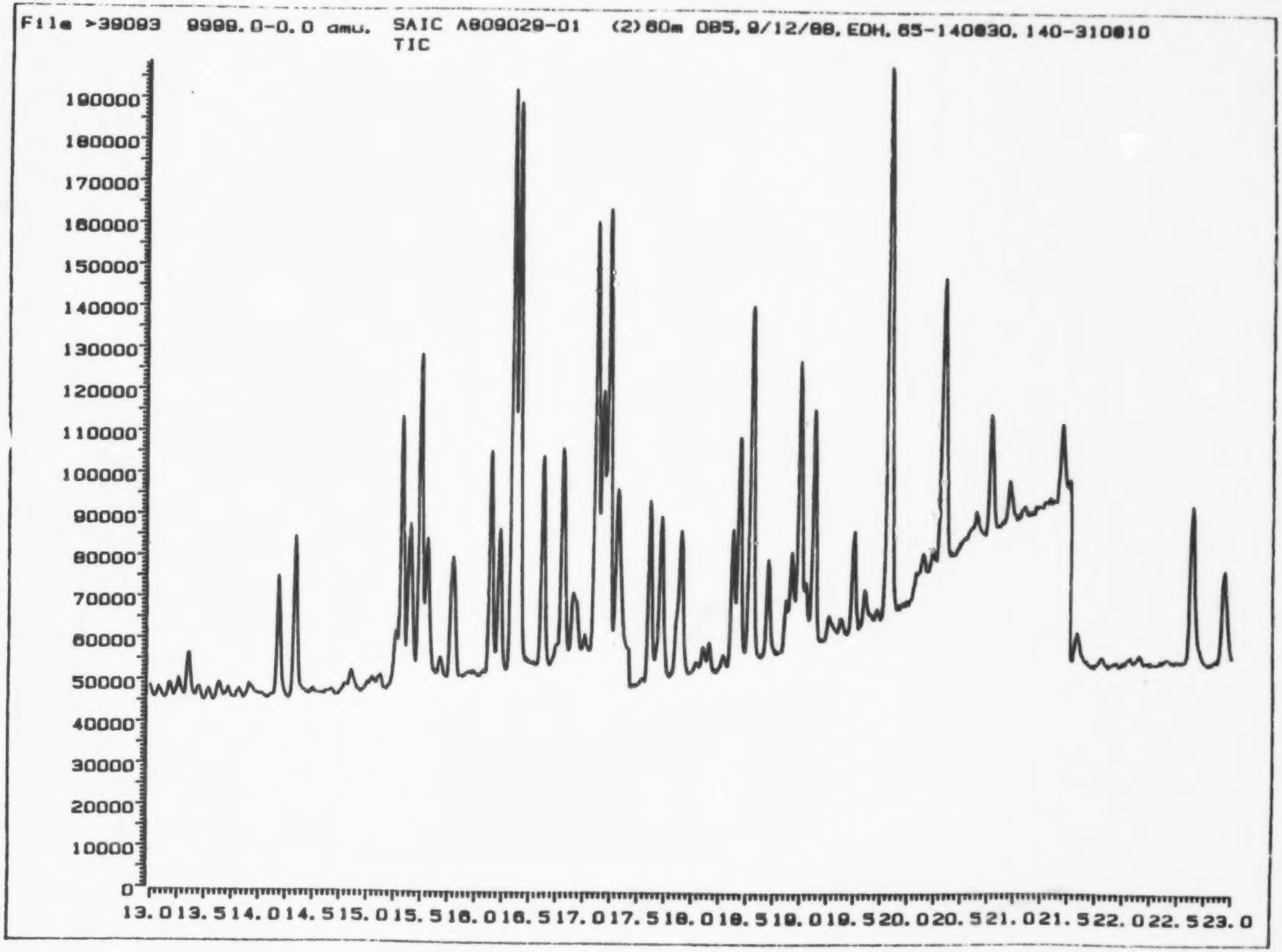


Figure 1. Total Ion Current Chromatogram for SAIC Feed Sample

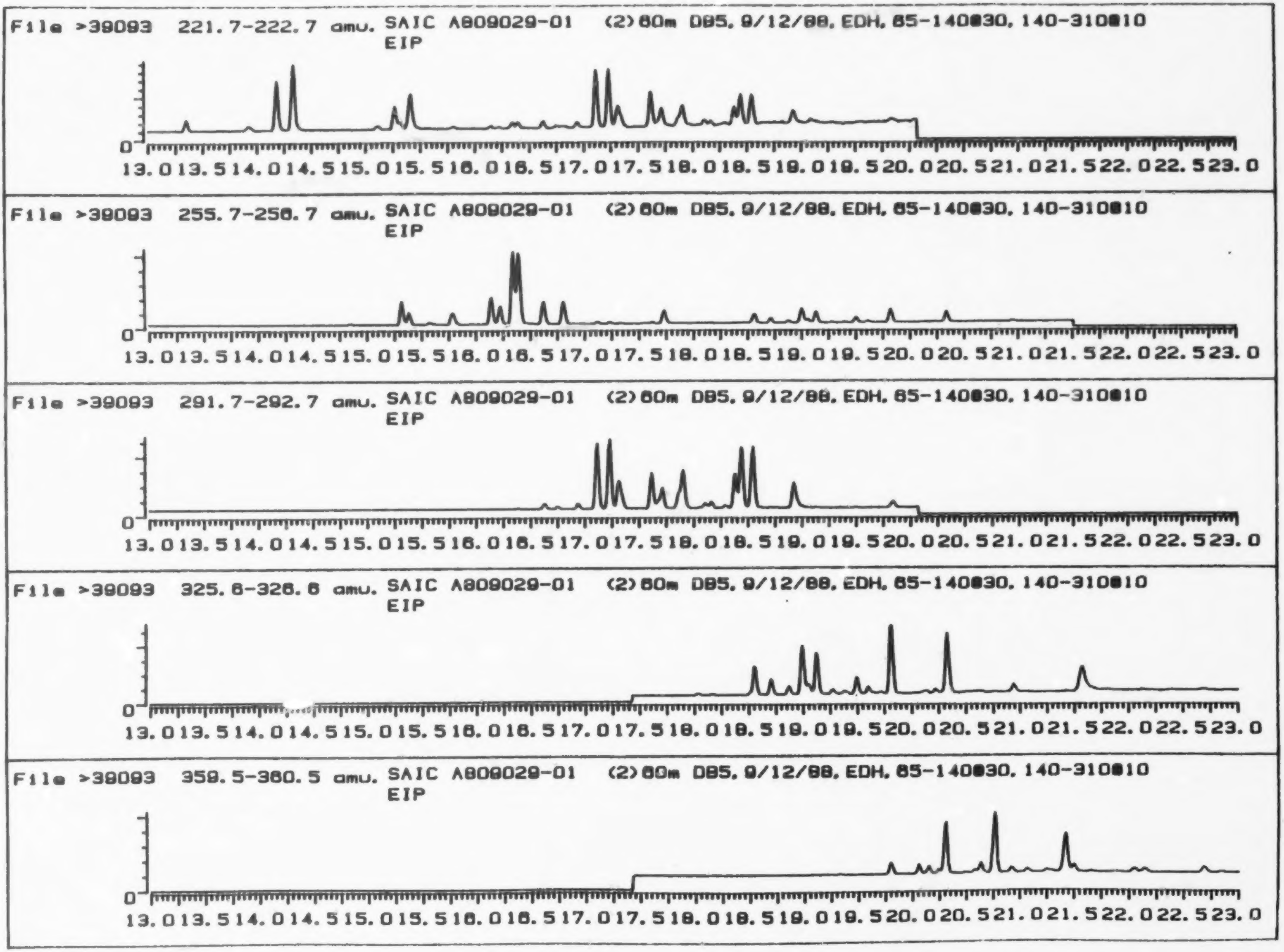


Figure 2. Extracted Ion Current Profile Chromatograms for SAIC Feed Sample

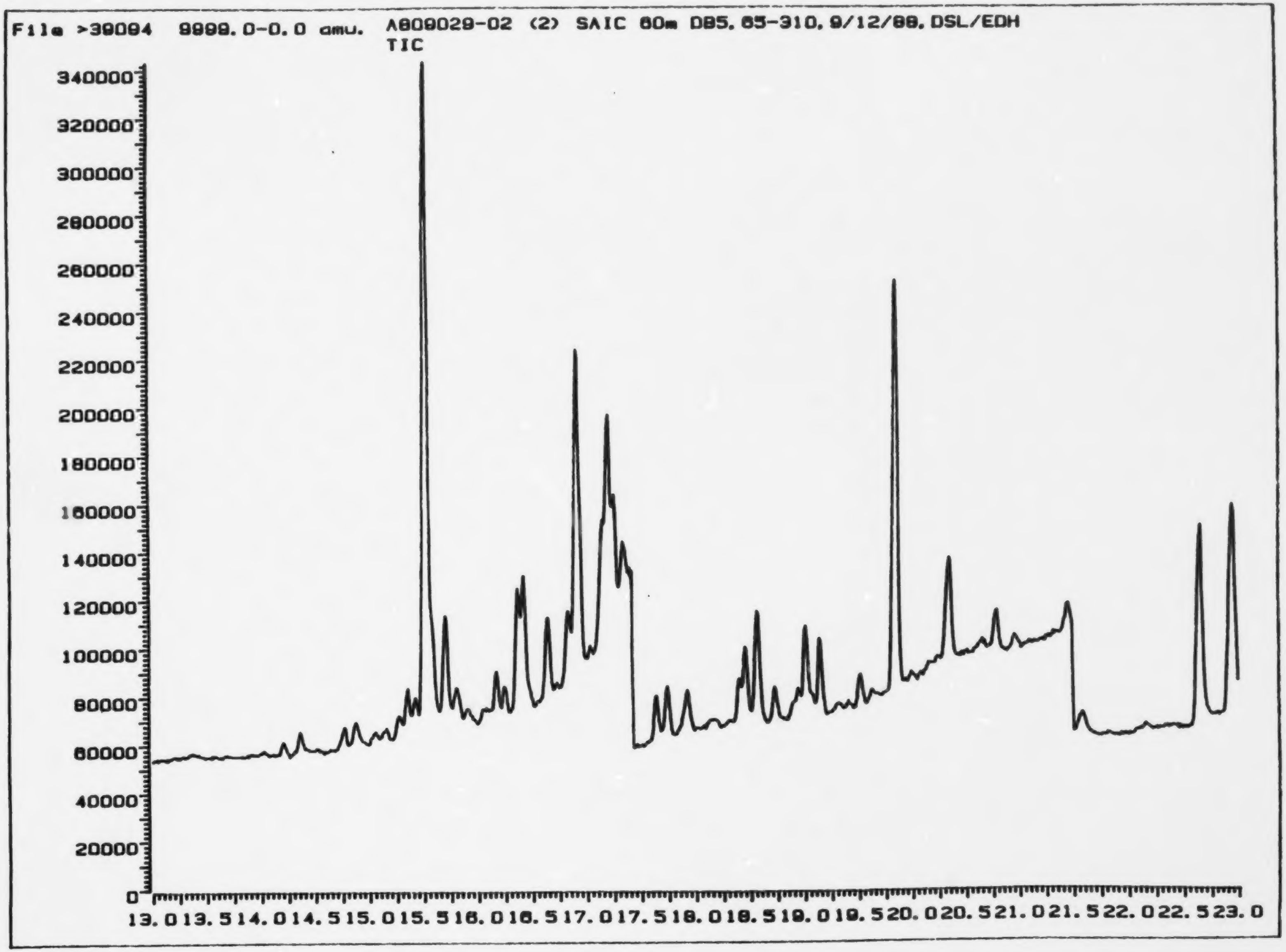


Figure 3. Total Ion Current Chromatogram for SAIC Raffinate Sample

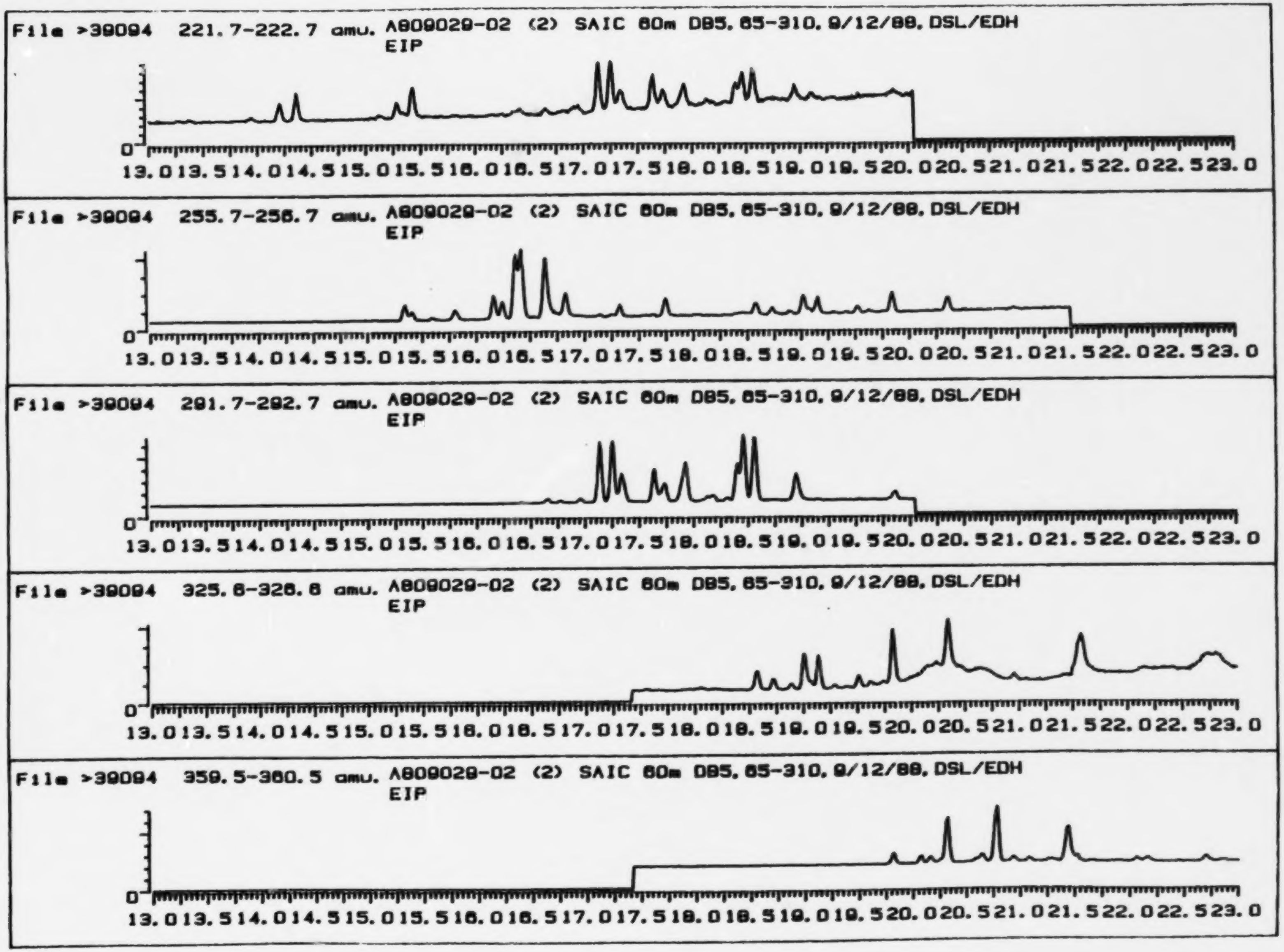


Figure 4. Extracted Ion Current Profile Chromatograms for SAIC Raffinate Sample

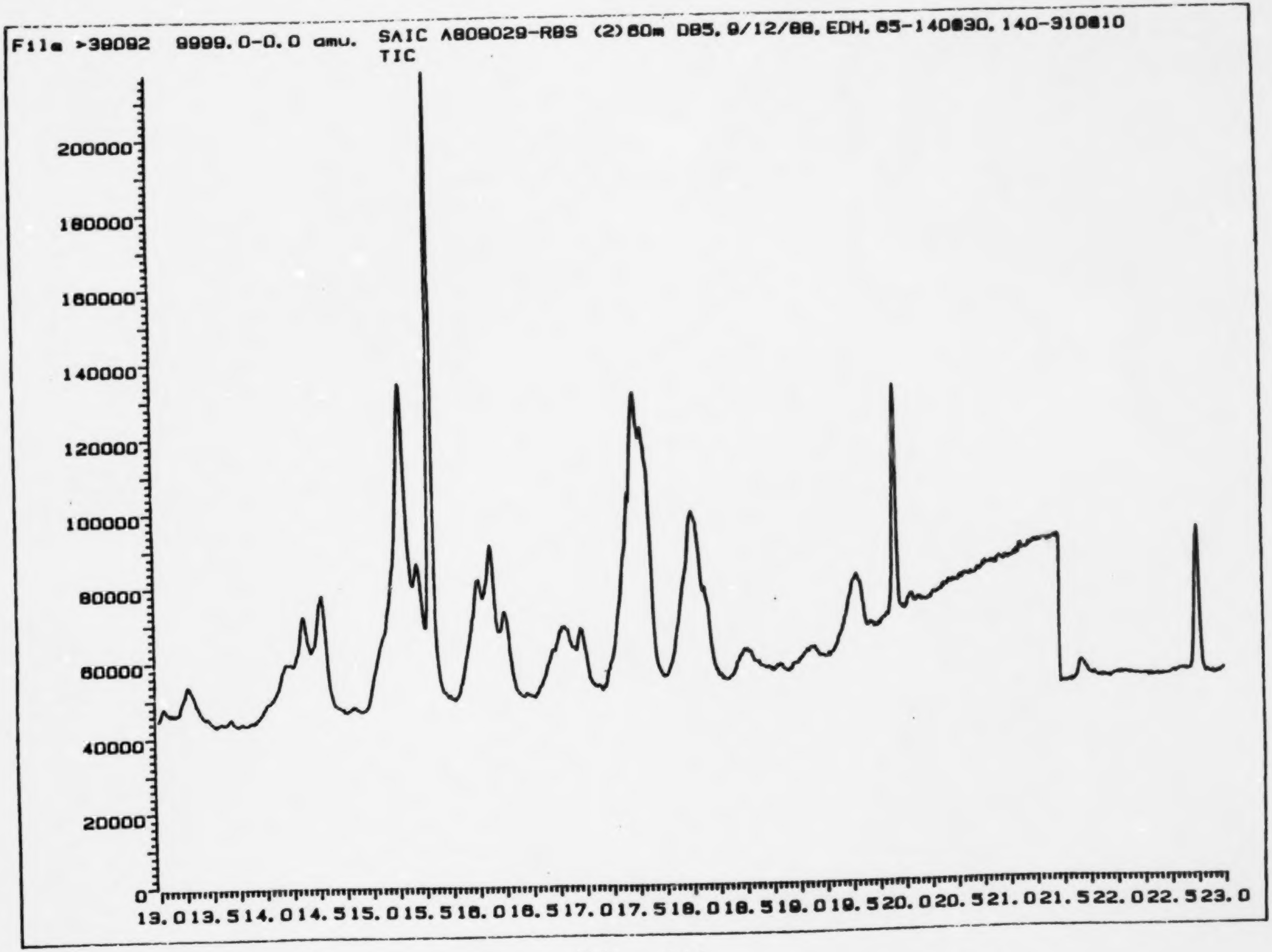


Figure 5. Total Ion Current Chromatogram for SAIC Reagent Blank

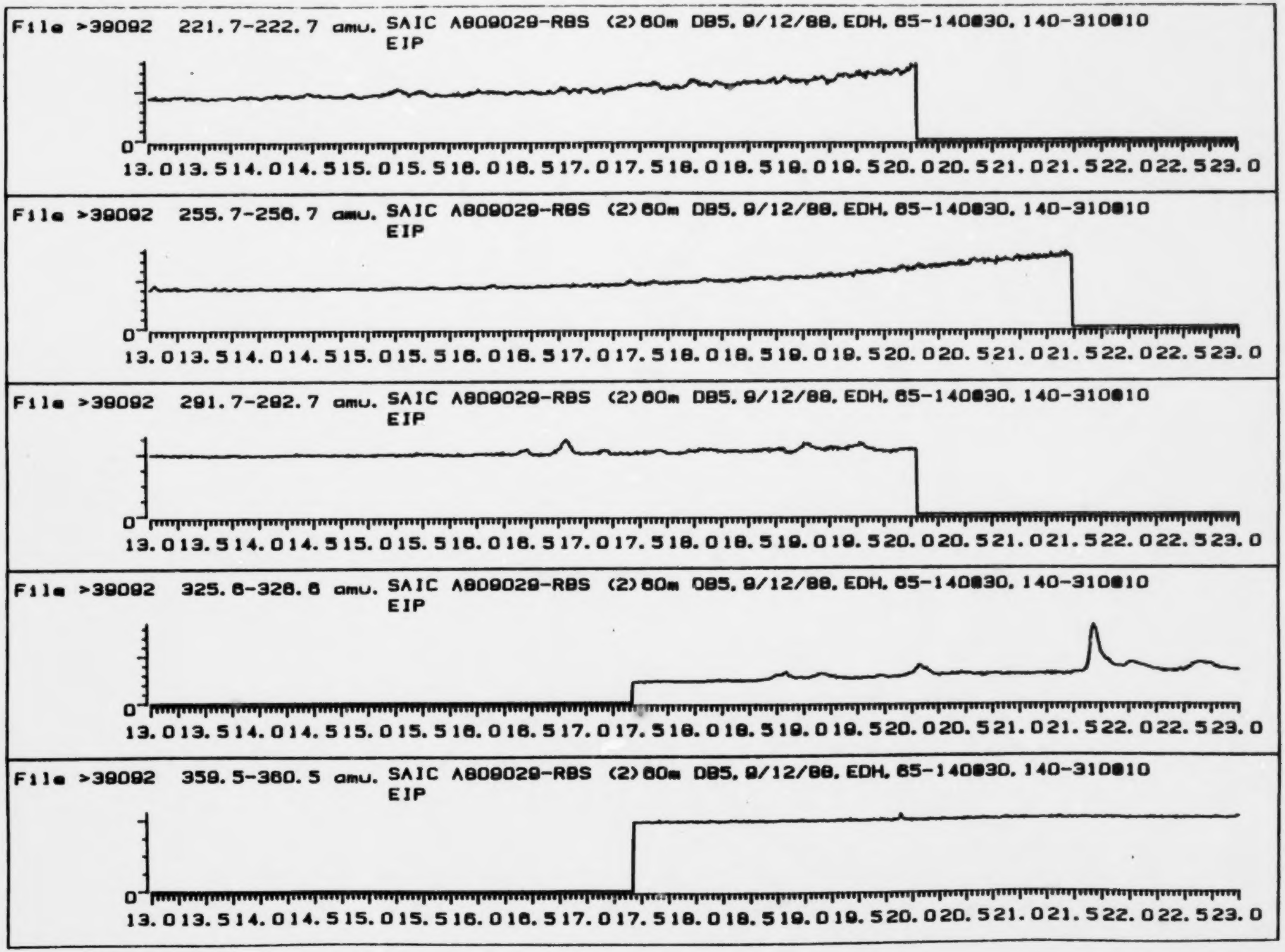


Figure 6. Extracted Ion Current Profile Chromatograms for SAIC Reagent Blank

TABLE 4-1. SAIC PCB DATA BY ISOMER CLASS - DEMO 1

	Feed		Raffinate		Oil	Blank
Isomer Class	Wet Wt. ng/g	Dry Wt. ng/g	Wet Wt. ng/mL	Dry Wt. ng/g	ng/mL[a]	ng/mL Assuming 0.5 mL Sample
Mono-	<400	<1500	<40	<2100	<400	<40
Di-	3900	15000	<40	<2100	<400	<40
Tri-	21000	80000	350	18000	<400	<40
Tetra-	26000	100000	630	33000	<400	<40
Penta-	19000	71000	490	26000	<400	<40
Hexa-	3800	15000	110	6000	<400	<40
Hepta-	<400	<1500	<40	<2100	<400	<40
Octa-	<400	<1500	<40	<2100	<400	<40
Nona-	<2000	<7700	<200	<11000	<2000	<200
Deca-	<2000	<7700	<200	<11000	<2000	<200
TOTALS	73700	280000	1530	83000		

[a] Internal Standard not recovered. Detection limits based on an average IS response.

TABLE 4-2. SAIC MATRIX SPIKE/MATRIX SPIKE RECOVERY DATA - DEMO 1

Isomer Group	Matrix Spike	Matrix Spike Duplicate	Relative % Difference
Monochlorobiphenyl	0.5%[a]	8.2%[a]	177[a]
Dichlorobiphenyl	12%[a]	34%	96[a]
Trichlorobiphenyl	38%[a]	56%	38
Tetrachlorobiphenyl	36%[a]	54%	40
Pentachlorobiphenyl	77%	83%	7.5
Hexachlorobiphenyl	80%	87%	8.4
Heptachlorobiphenyl	80%	87%	8.4
Octachlorobiphenyl	88%	92%	4.4
Nonachlorobiphenyl	83%	87%	4.7
Decachlorobiphenyl	94%	95%	1.1

[a] Outside QC limits.

TABLE 4-3. METHOD 680 DATA COMPARISON BY DRY WEIGHT 5-POINT CALIBRATION CURVE - DEMO 1

	Feed (ng/g)	Raffinate (ng/g)	Feed to Raffinate Ratio
Di-	15000	ND	---
Tri-	80000	18000	4.4
Tetra-	100000	33000	3.0
Penta-	71000	26000	2.8
Hexa-	15000	6000	2.5
Totals	280000	83000	3.4

TABLE 4-4. SAIC SURROGATE RECOVERIES (%) - DEMO 1

Surrogate	Feed	Raffinate	Oil[a]	Blank
$^{13}C_6$-Monochlorobiphenyl	28[b]	7[b]	21[b]	18[b]
$^{13}C_{12}$-Tetrachlorobiphenyl	72	73	58	90
$^{13}C_{12}$-Octachlorobiphenyl	74	87	73	79
$^{13}C_{12}$-Decachlorobiphenyl	93	96	107	94

[a] Internal Standard not recovered. Recoveries based on an average IS response.
[b] Outside QC limits.

TABLE 4-5. TENTATIVE IDENTIFICATION AND RELATIVE AMOUNTS OF AROCLORS[a] - DEMO 1

	Feed	Raffinate
Aroclor 1016 and/or 1242	34%	15%
Aroclor 1248	49%	63%
Aroclor 1254	17%	22%

[a] Estimated using the program developed by L. E. Silvon, Battelle.

TABLE 4-6. METHOD 680 PCB ISOMER GROUP RATIO COMPARISONS
5-POINT CALIBRATION CURVE - DEMO 1

	Feed	Raffinate	Relative % Diff
Di:Tri Ratio	0.186	0	---
Di:Tetra Ratio	0.146	0	---
Di:Penta Ratio	0.209	0	---
Di:Hexa Ratio	1.01	0	---
Tri:Tetra Ratio	0.786	0.547	35.8
Tri:Penta Ratio	1.12	0.706	45.6
Tri:Hexa Ratio	5.45	3.07	55.9
Tetra:Penta Ratio	1.43	1.29	10.2
Tetra:Hexa Ratio	6.92	5.60	21.1
Penta:Hexa Ratio	4.85	4.34	11.0

level chlorinated PCBs appear to be extracted more efficiently from the feed samples by the liquid propane, the use of Aroclor mixtures to represent the PCBs present in the oil or raffinate is probably an oversimplification. The computer program may also be biased in the ability to determine the Aroclors present as the concentrations of the isomer group found in the sample are compared to a matrix table of concentrations from native Aroclor mixtures.

4.2 Phase Two - Demo 4, Pass 4

4.2.1 Method 680 - GC/MS

The extracted ion current profile (EICP) chromatograms for the major ion of each isomer class, monochlorobiphenyl through decachlorobiphenyl, and the total ion current (TIC) chromatograms are included as Figures 7 through 33. Figure 7 shows the TICs of the three blanks and the 5 ppm standard. Figures 8 and 9 are the TICs of the duplicate feed, raffinate, and oil samples along with the MS/MSD of the raffinate sample. Figure 10 is the EICPs for the mono- through penta- isomers for the 5 ppm standard. The hexa- through deca-isomers are shown in Figure 11. All of the remaining figures are EICPs of samples or reagent blanks. Table 4-7 lists the amount of PCBs found in each duplicate pair of samples by isomer class (for both wet and dry weights) along with the relative percent differences (RPD) in the duplicate samples. These data show very little differences in the duplicates. The RPD for the feed ranges from 0 to 4.2 percent. The raffinate RPDs range from 0 to 7.4 percent, while the extract oil ranges from 5.0 to 12 percent. The matrix spike/matrix spike duplicate data are presented in Table 4-8. Table 4-9 is the data comparison of the feed, raffinate and extracted oil samples on a dry weight determination. These values are based on the average of the duplicate analyses. The feed sample was 18.3% solids and the raffinate sample was 10.2% solids. According to these determinations, the liquid propane removed 96% of the total PCBs that were present in the feed. The percent recoveries of the ^{13}C-labelled surrogates are given in Table 4-10.

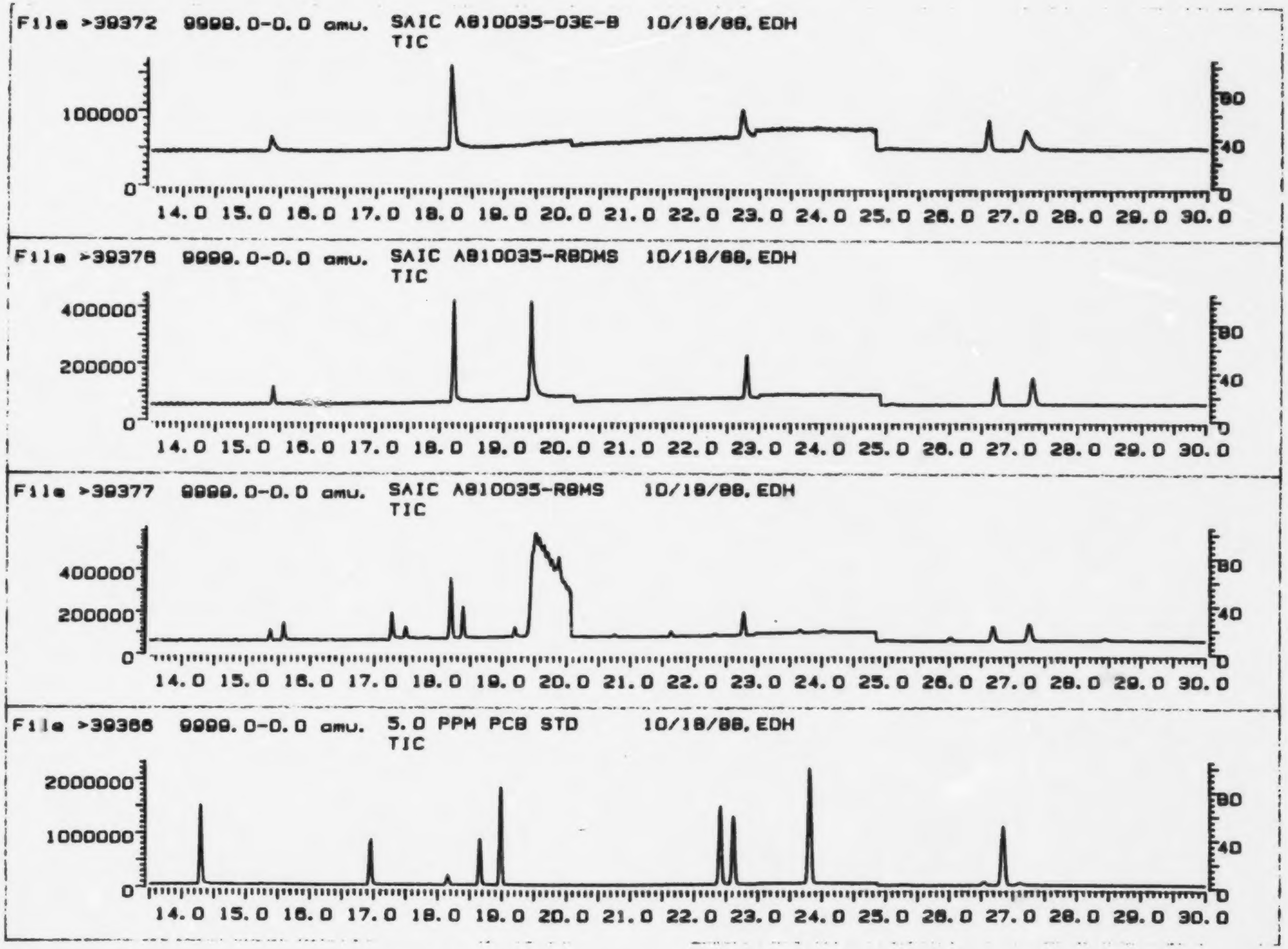


Figure 7. Total Ion Current (TIC) Chromatogram of Blanks (top 3) and 5 ppm Standard.

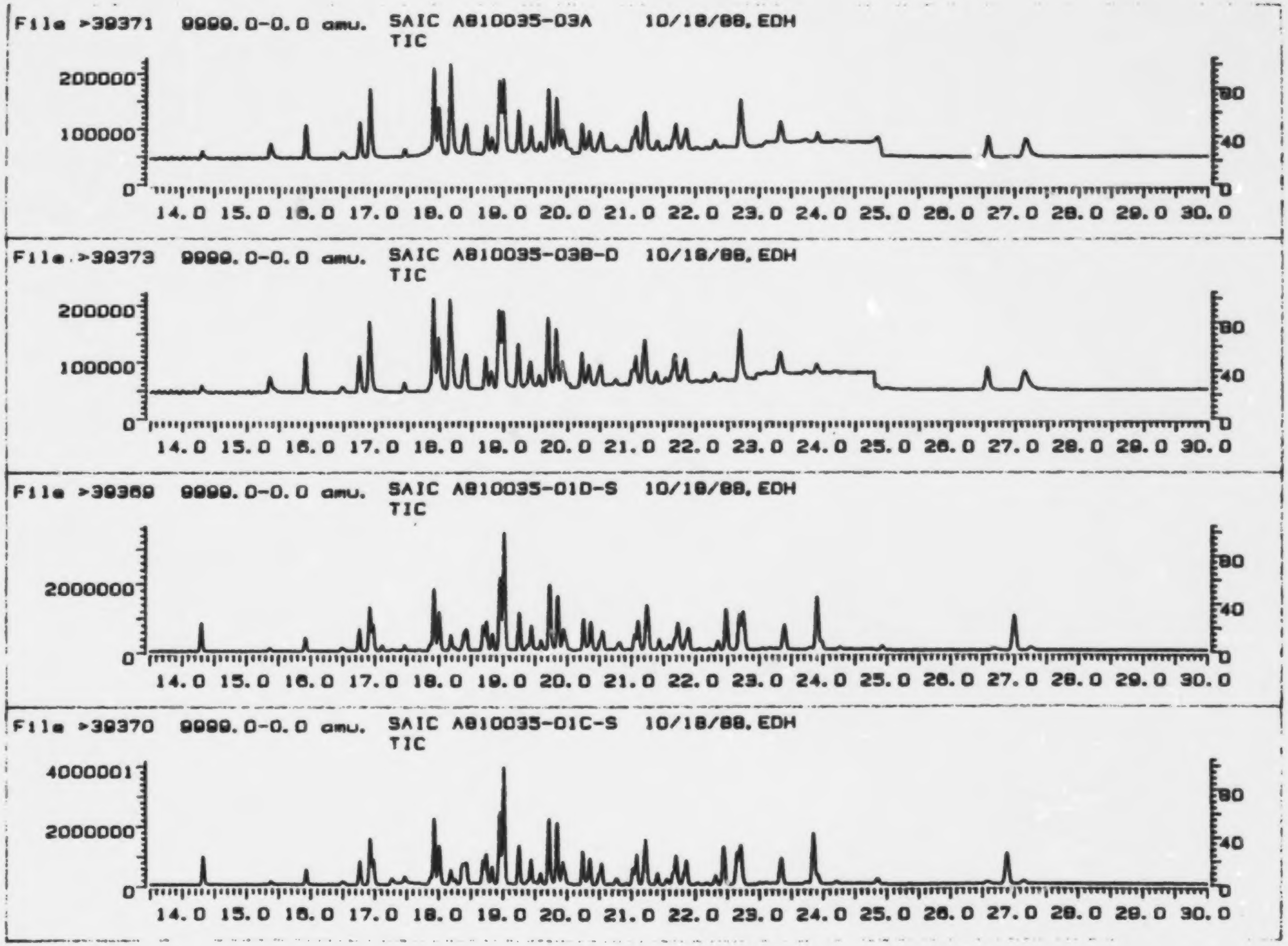


Figure 8. TICs of Duplicate Feed (top) and Raffinate Matrix Spike/Matris Spike Duplicate (bottom) Samples.

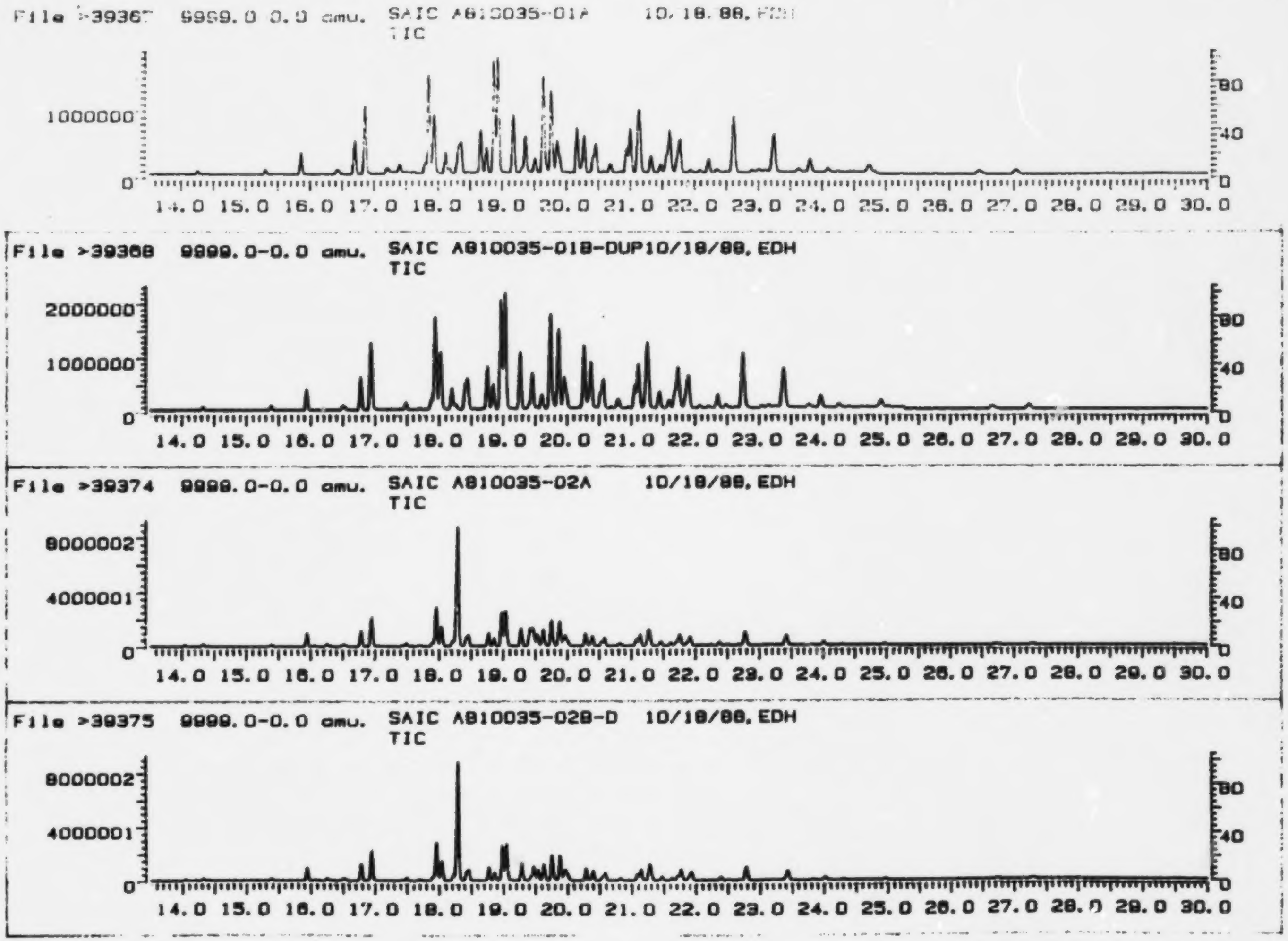


Figure 9. TICs of Duplicate Raffinate (top) and Oil Samples (bottom).

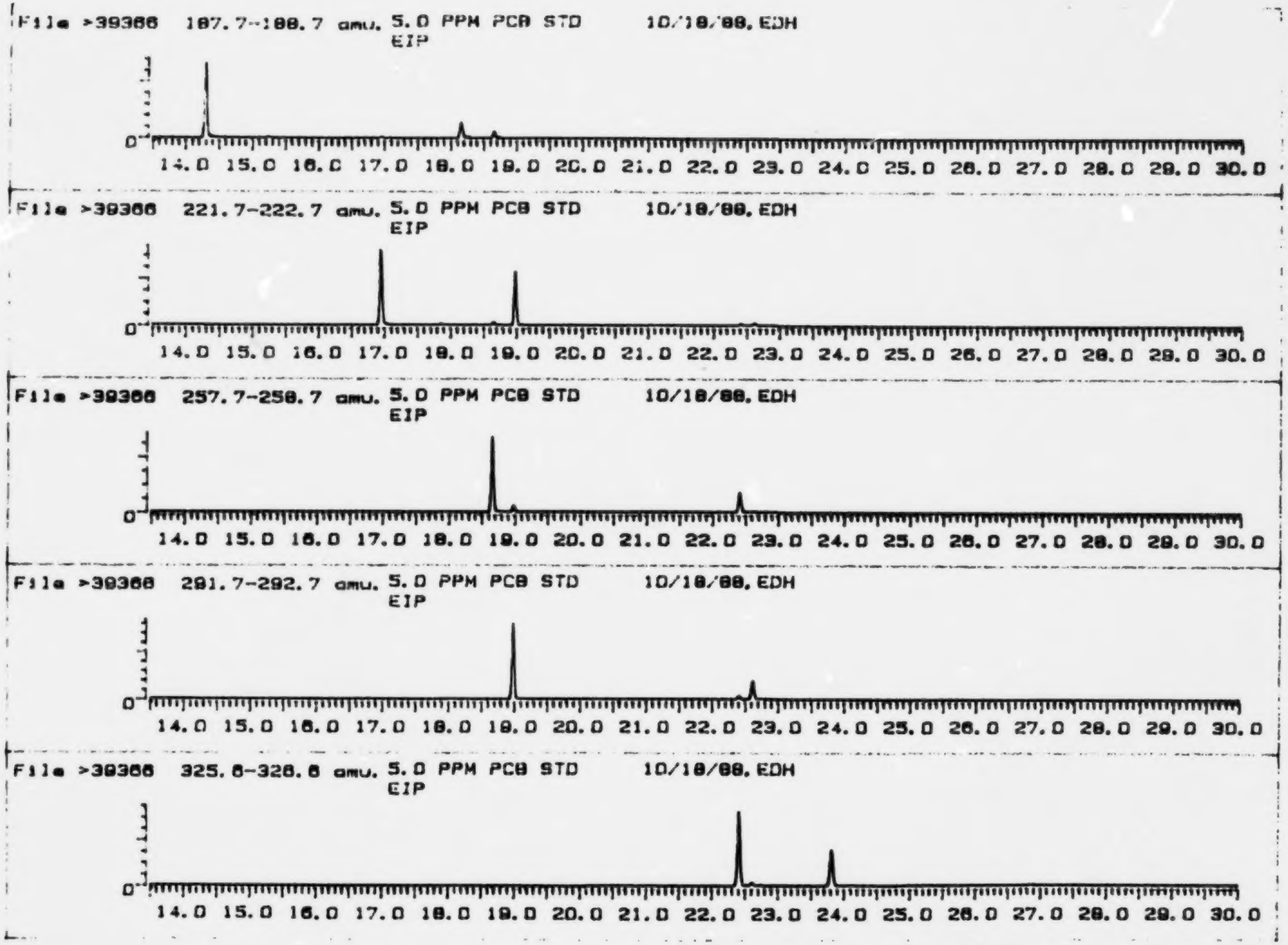


Figure 10. Extracted Ion Current Profiles (EICPs) for Mono- Through Penta- Isomers of 5 ppm Standard.

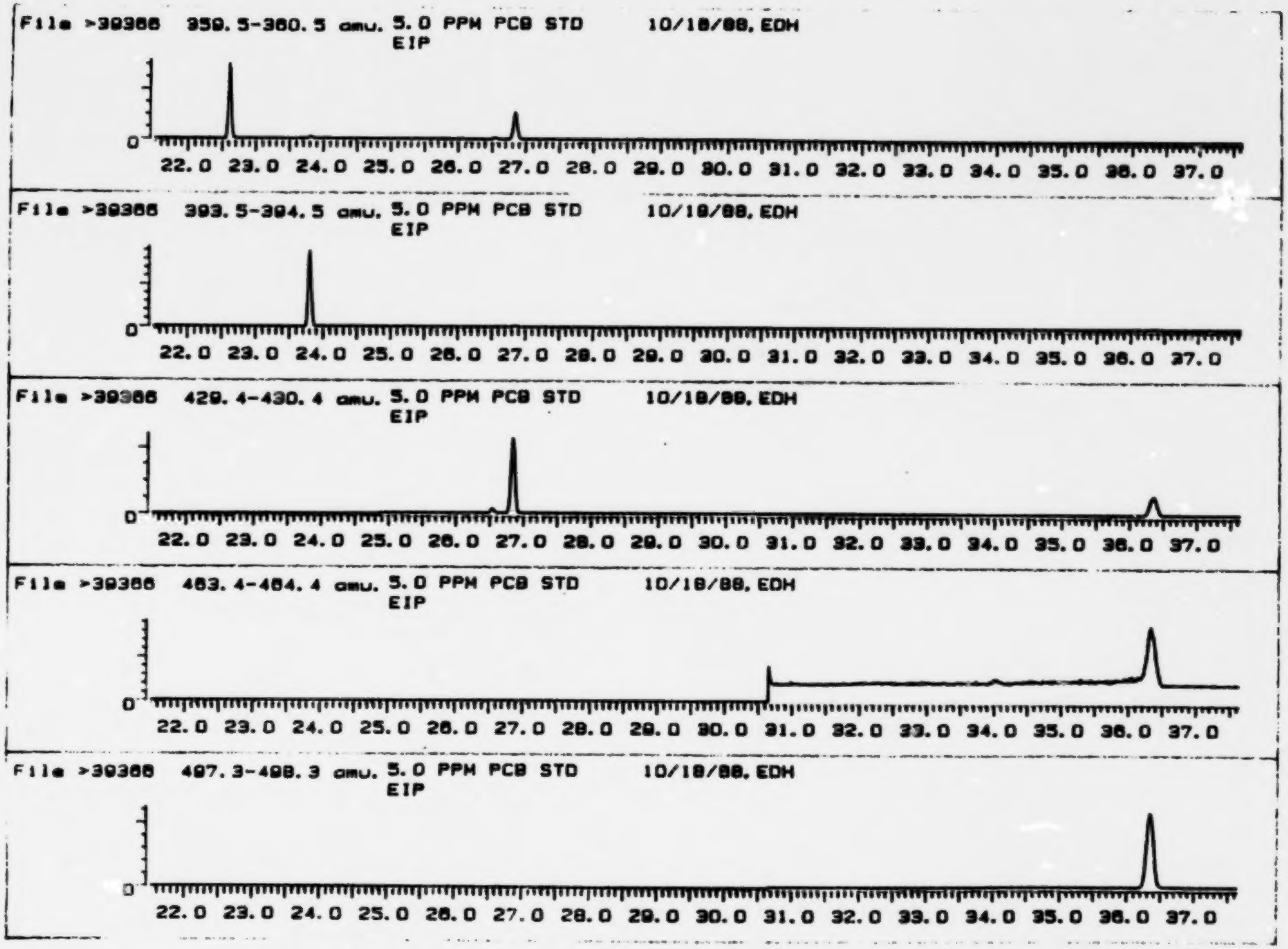


Figure 11. EICPs of Hexa- Through Deca- Isomers of 5 ppm Standard.

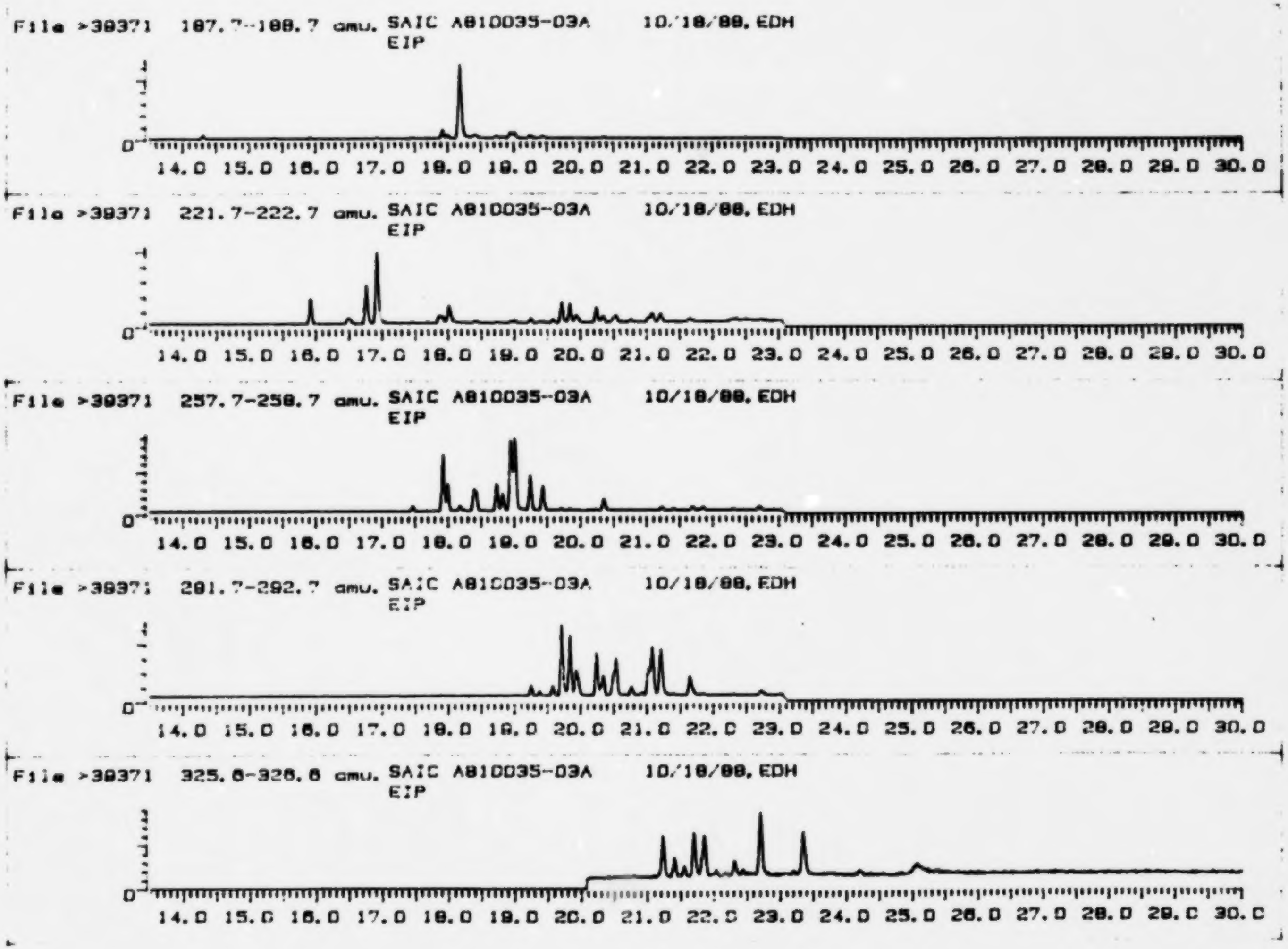


Figure 12. EICPs of Mono- Through Penta- Isomers of Feed Sample.

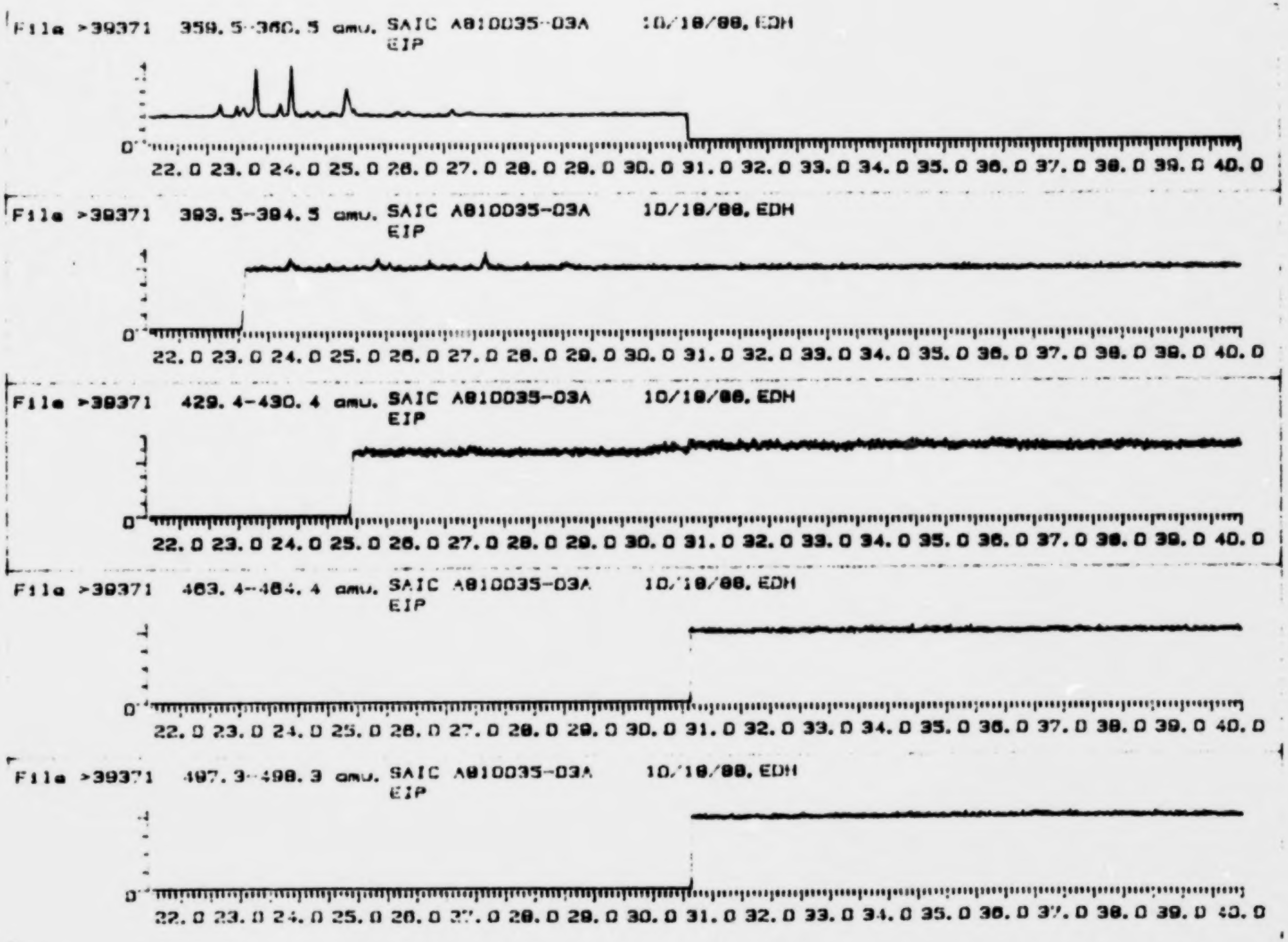


Figure 13. EICPs of Hexa- Through Deca- Isomers of Feed Sample.

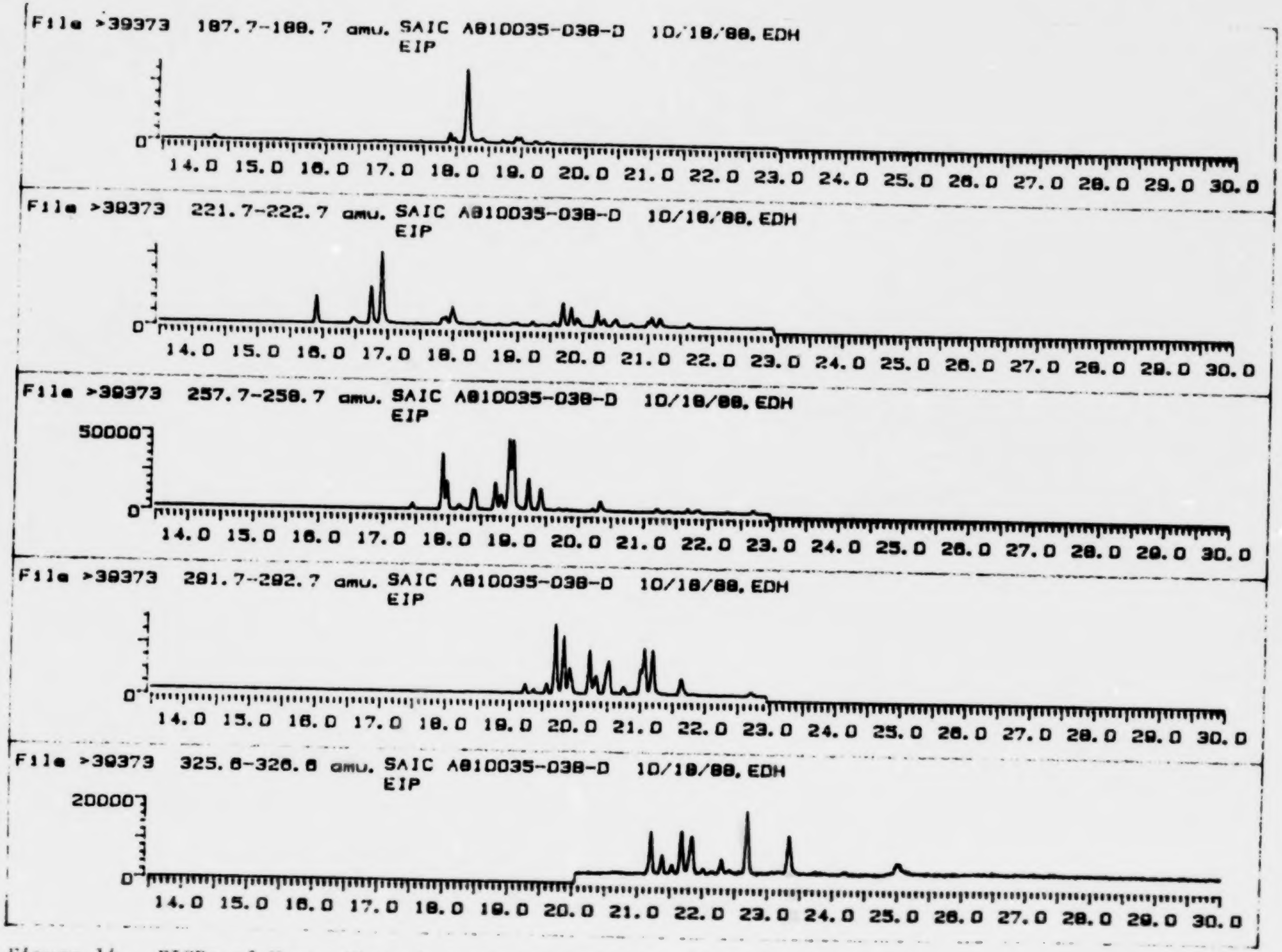


Figure 14. EICPs of Mono- Through Penta- Isomers of Duplicate Feed Sample.

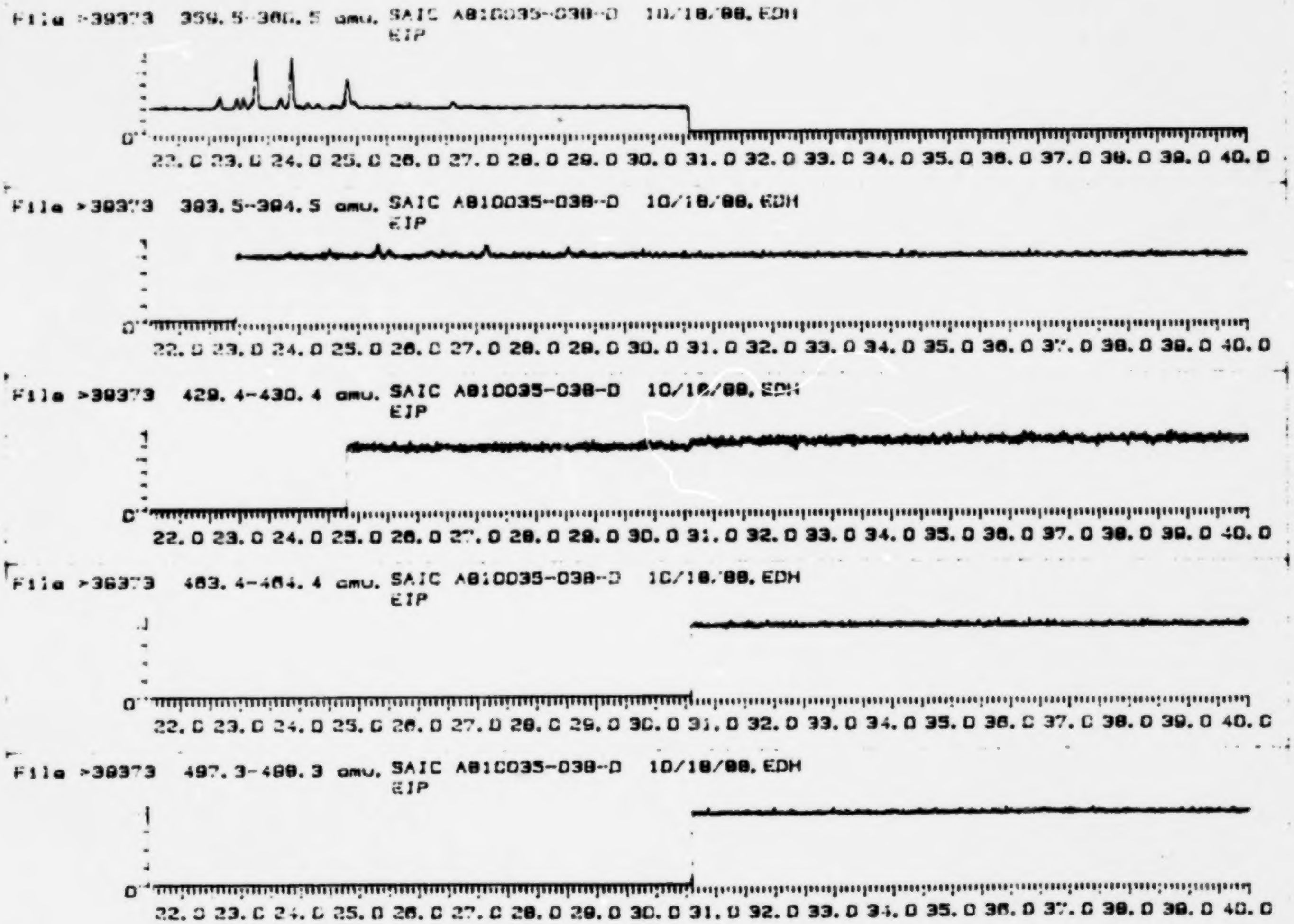


Figure 15. EICPs of Hexa- Through Deca- Isomers of Duplicate Feed Sample.

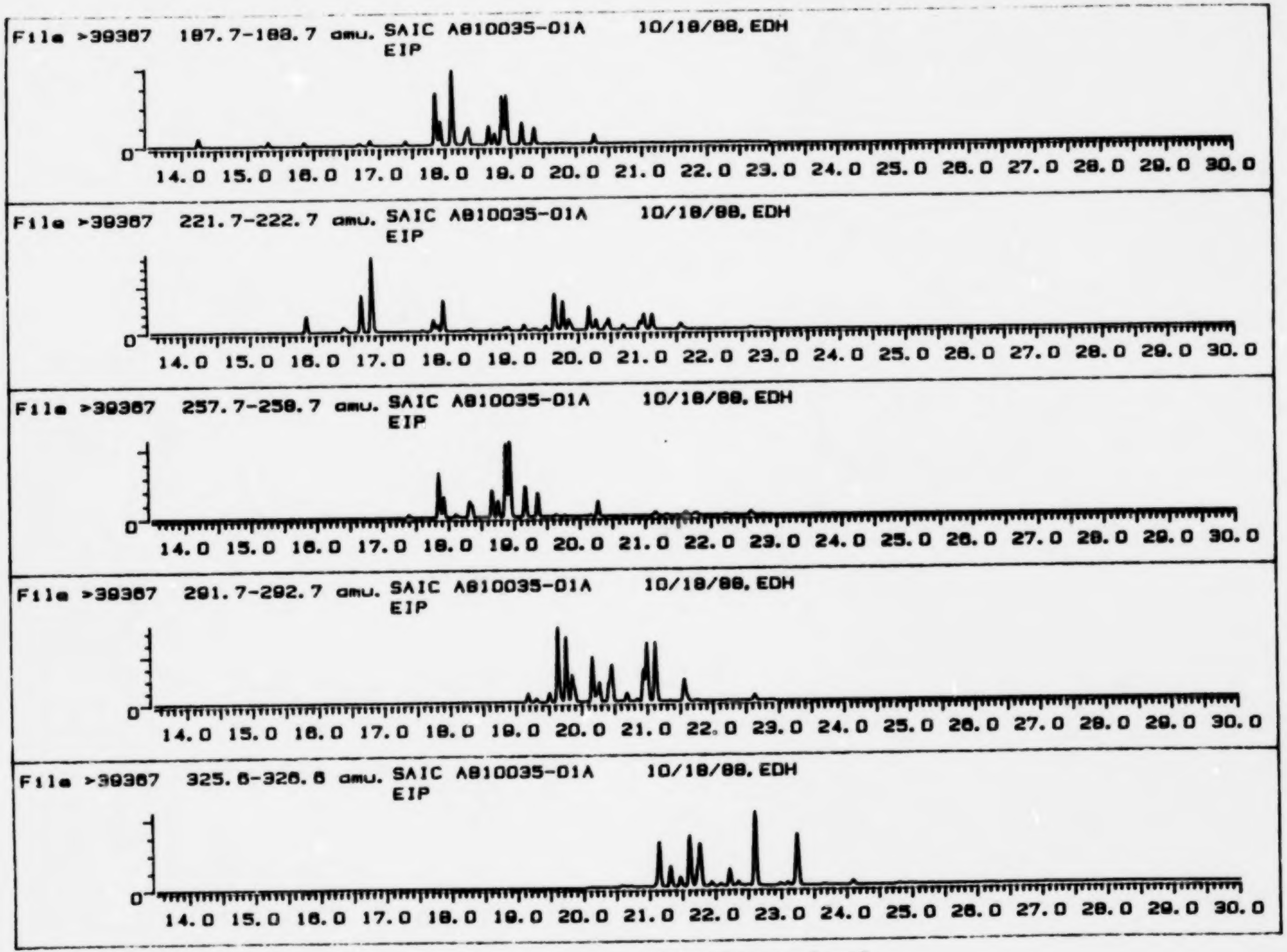


Figure 16. EICPs of Mono- Through Penta- Isomers of Raffinate Sample.

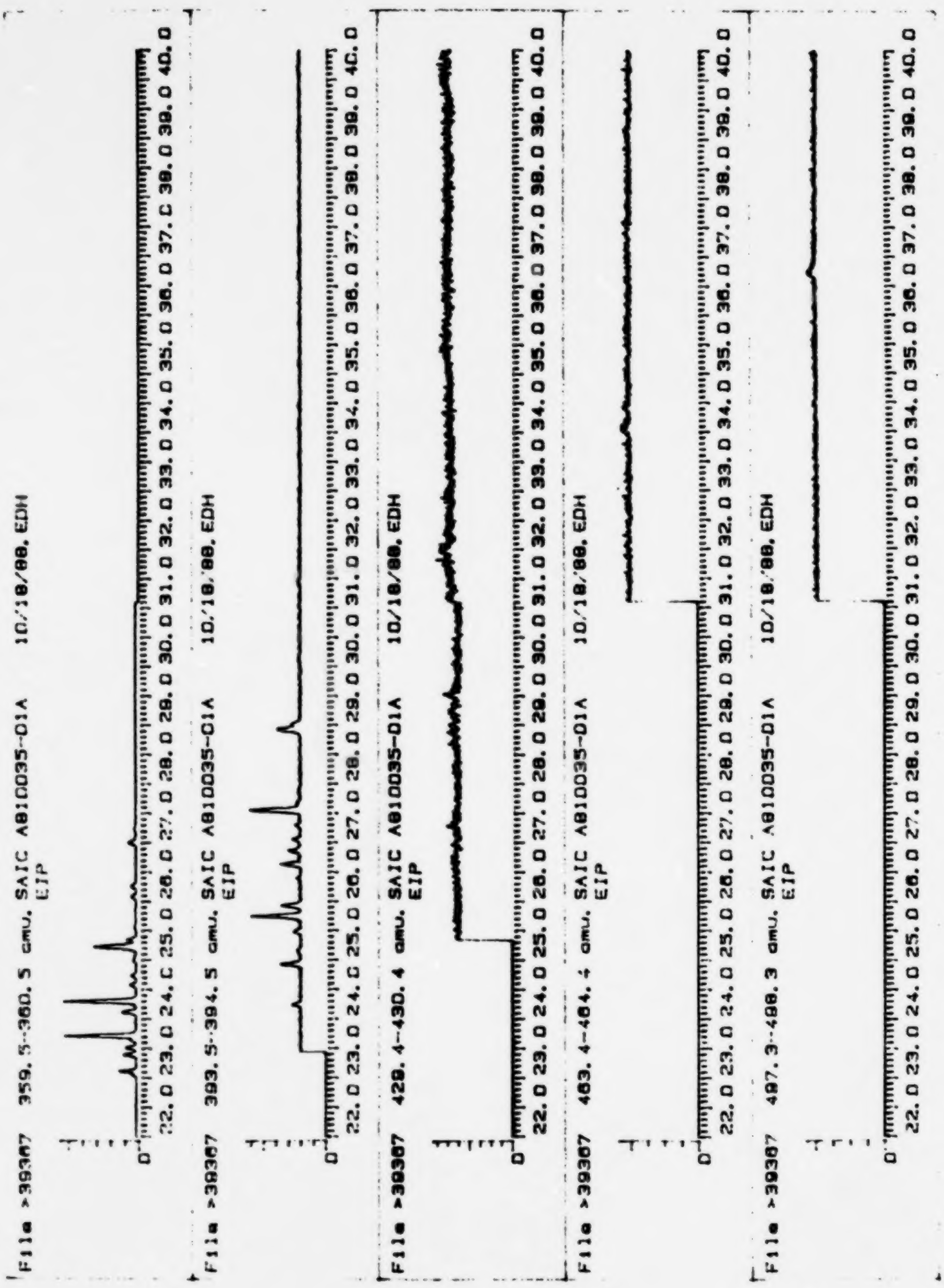


Figure 17. EICPs of Hexa- Through Deca- Isomers of Raffinate Sample.

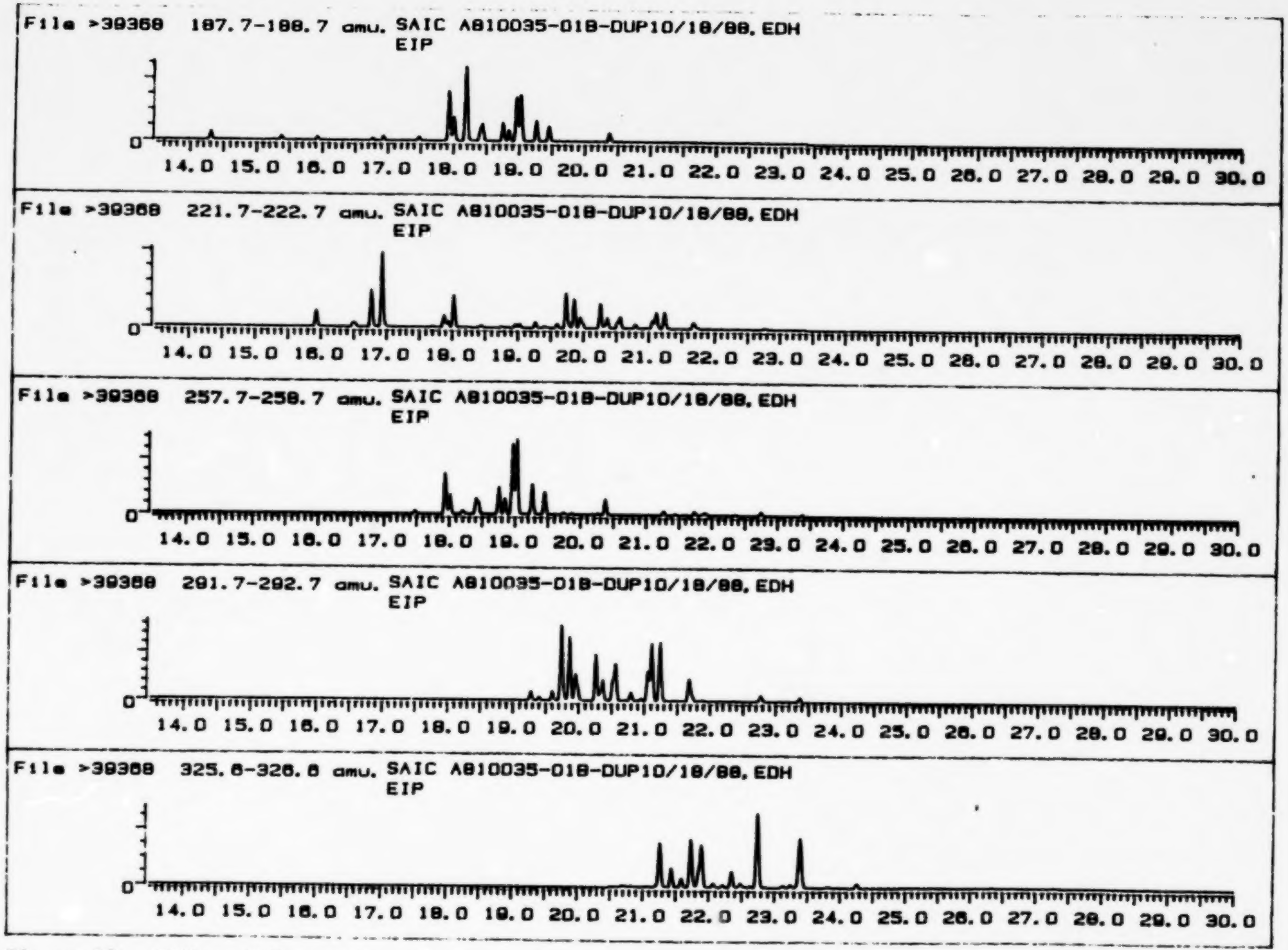


Figure 18. EICPs of Mono- Through Penta- Isomers of Duplicate Raffinate Sample.

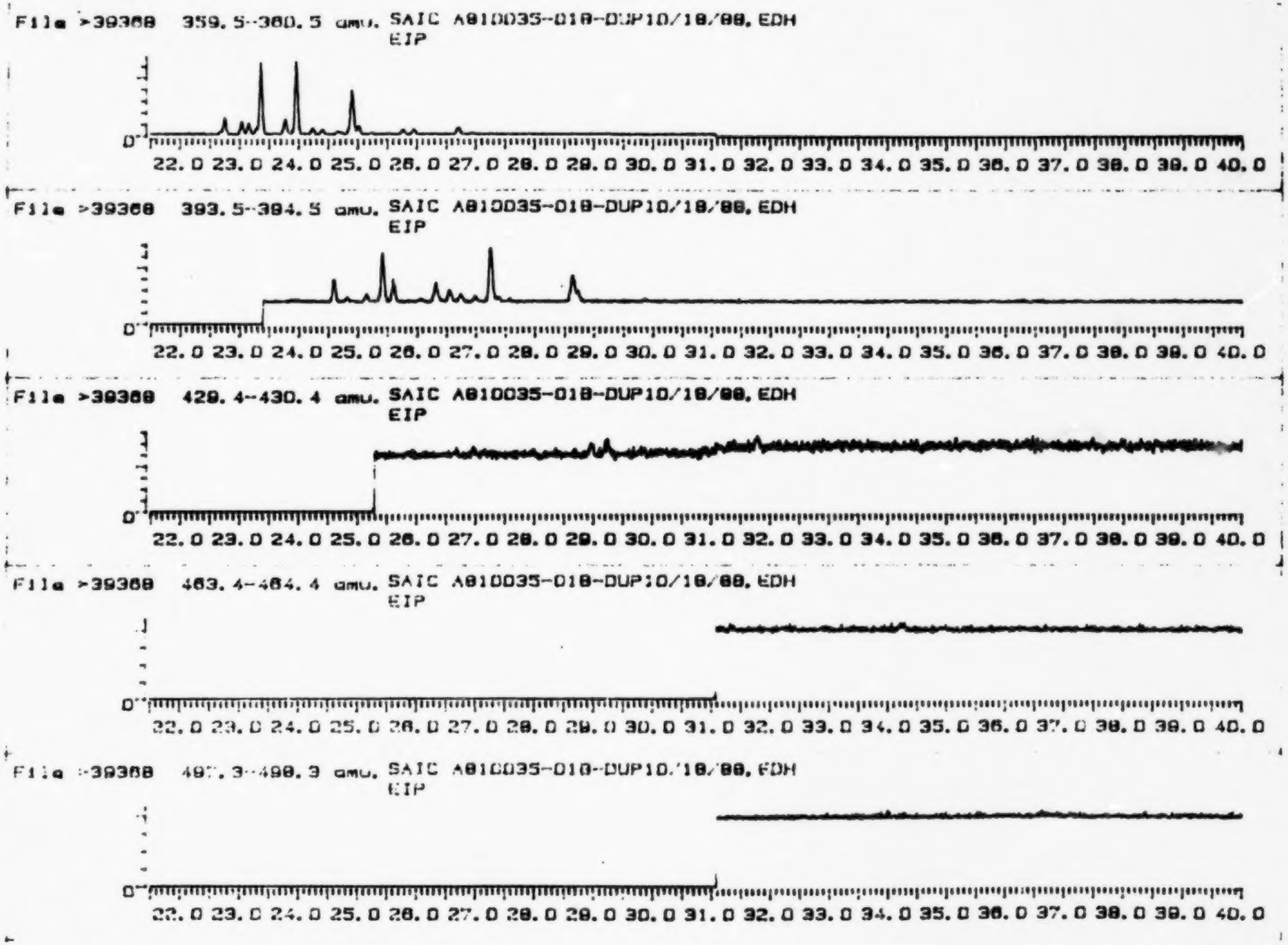


Figure 19. EICPs of Hexa- Through Deca- Isomers of Duplicate Raffinate Sample.

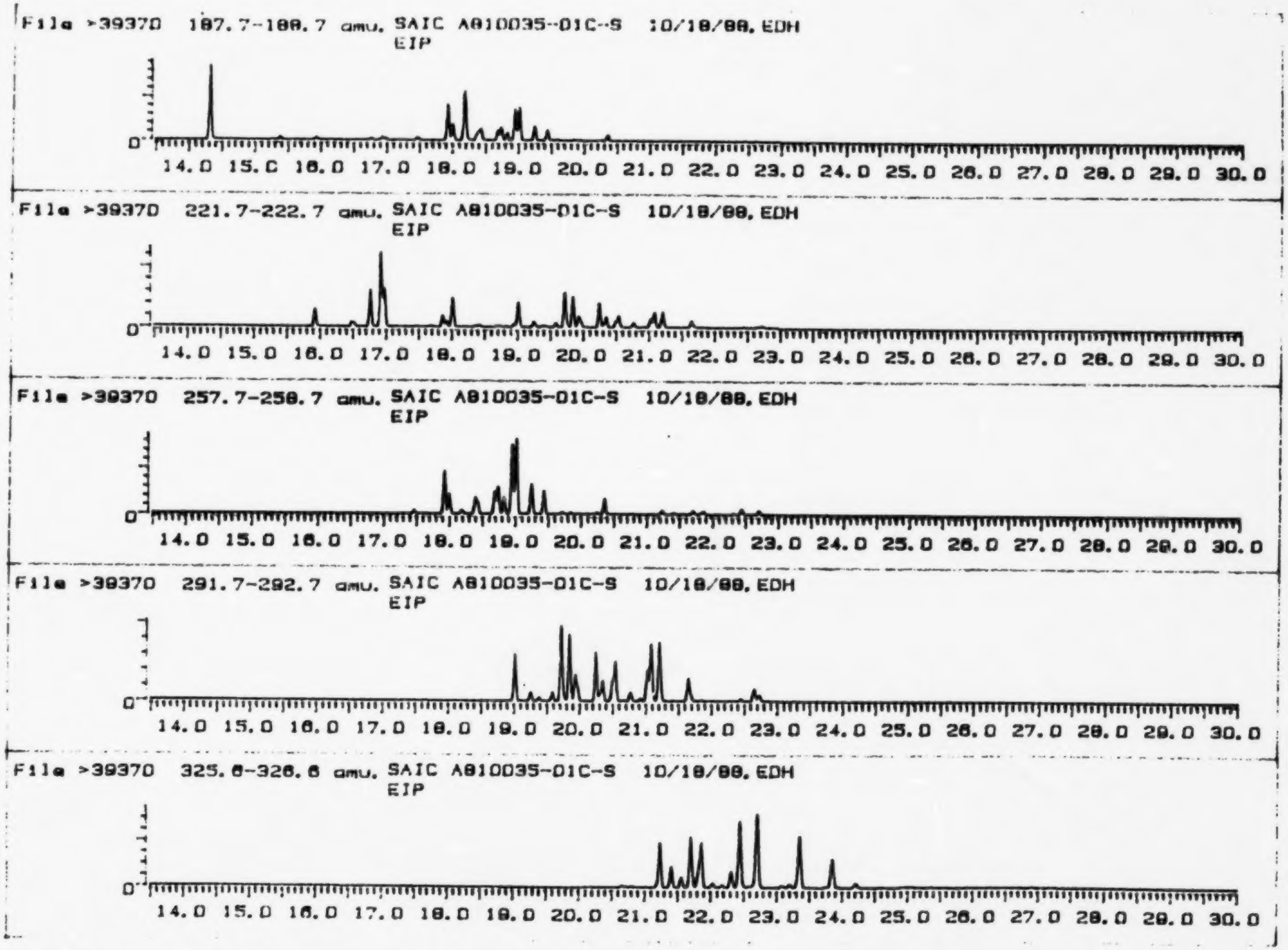


Figure 20. EICPs of Mono- Through Penta- Isomers of Raffinate Matrix Spike Sample.

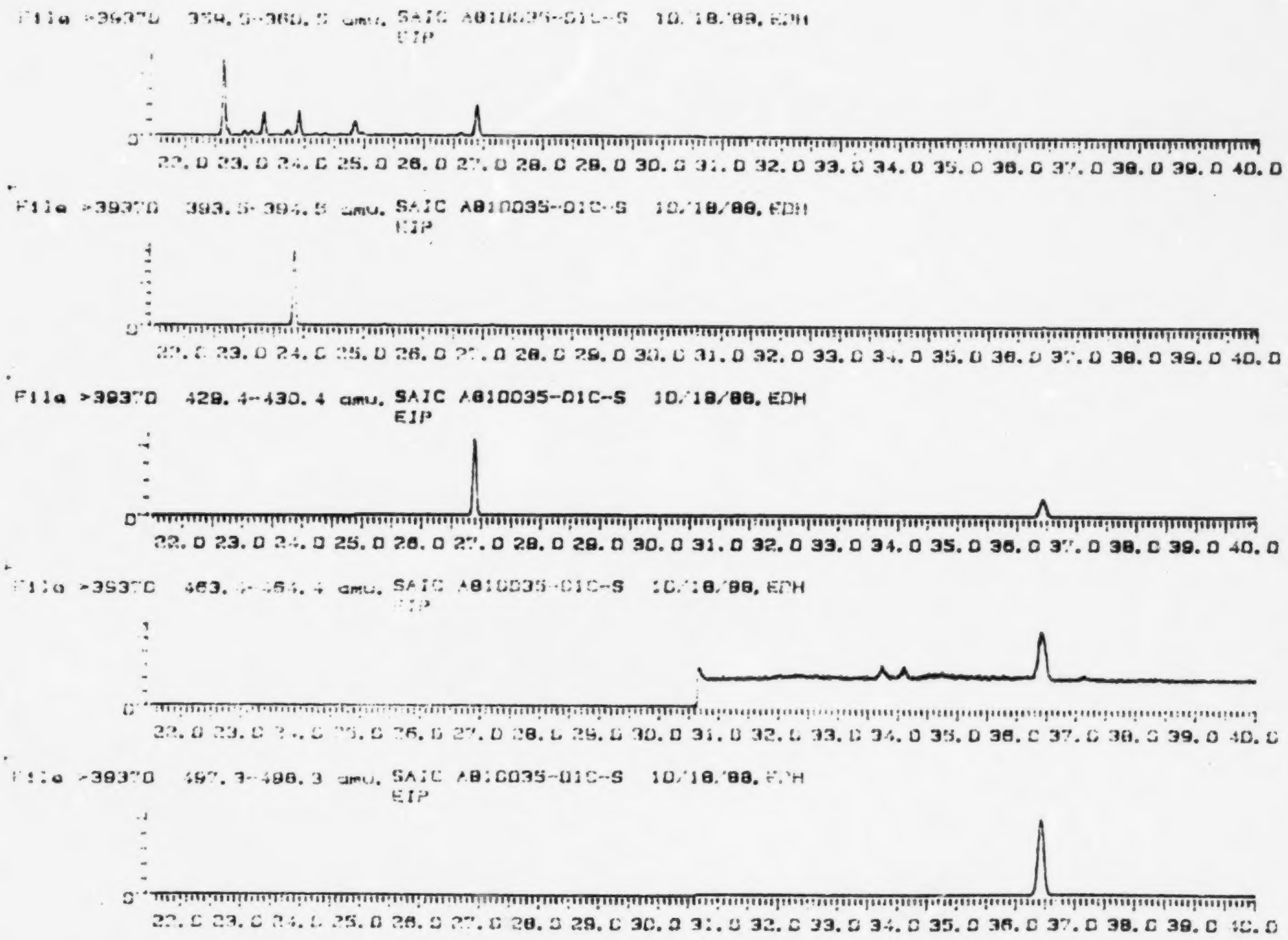


Figure 21. EICPs of Hexa- Through Deca- Isomers of Raffinate Matrix Spike Sample.

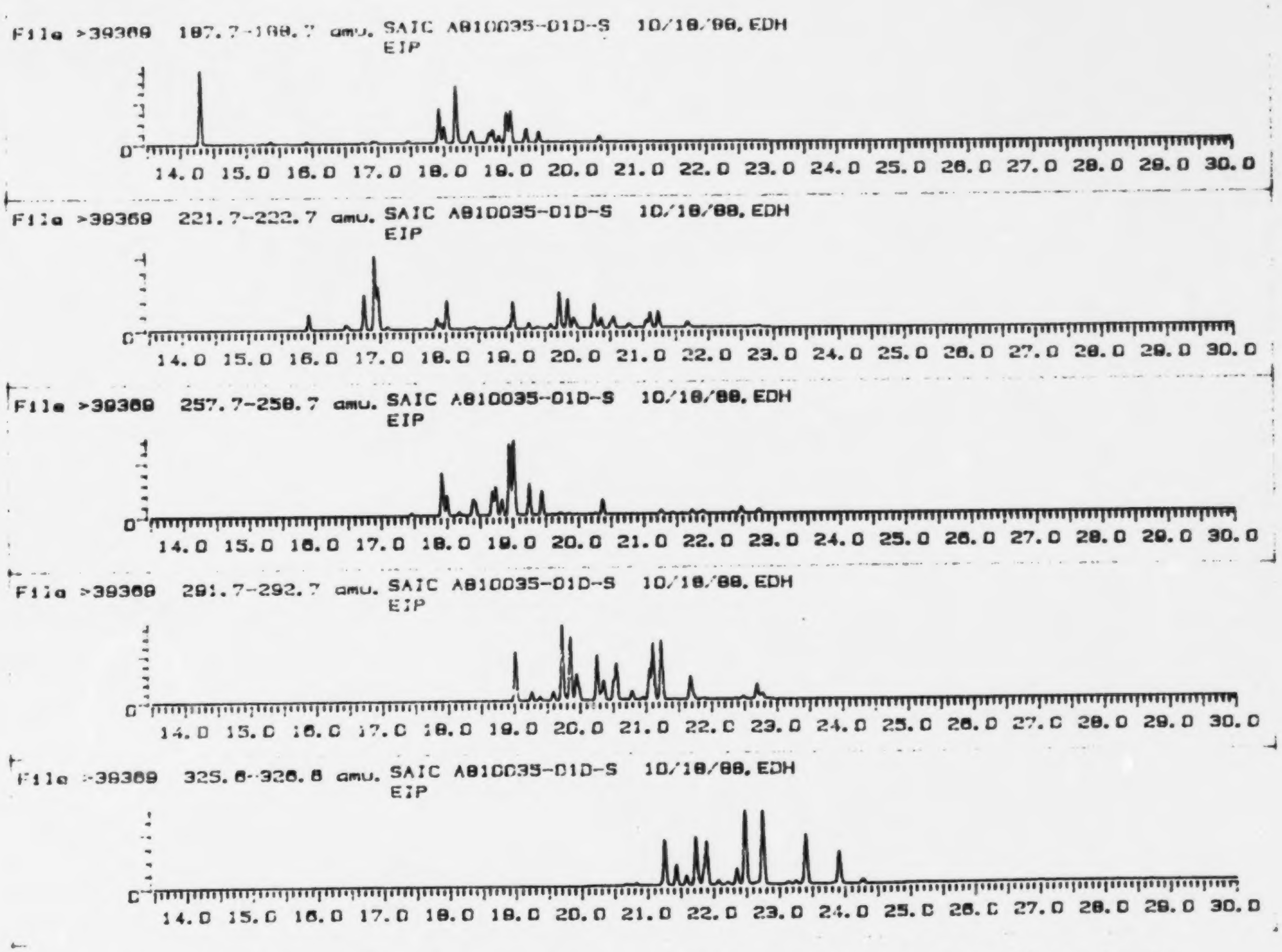


Figure 22. EICPs of Mono- Through Penta- Isomers of Raffinate Matrix Spike Duplicate Sample.

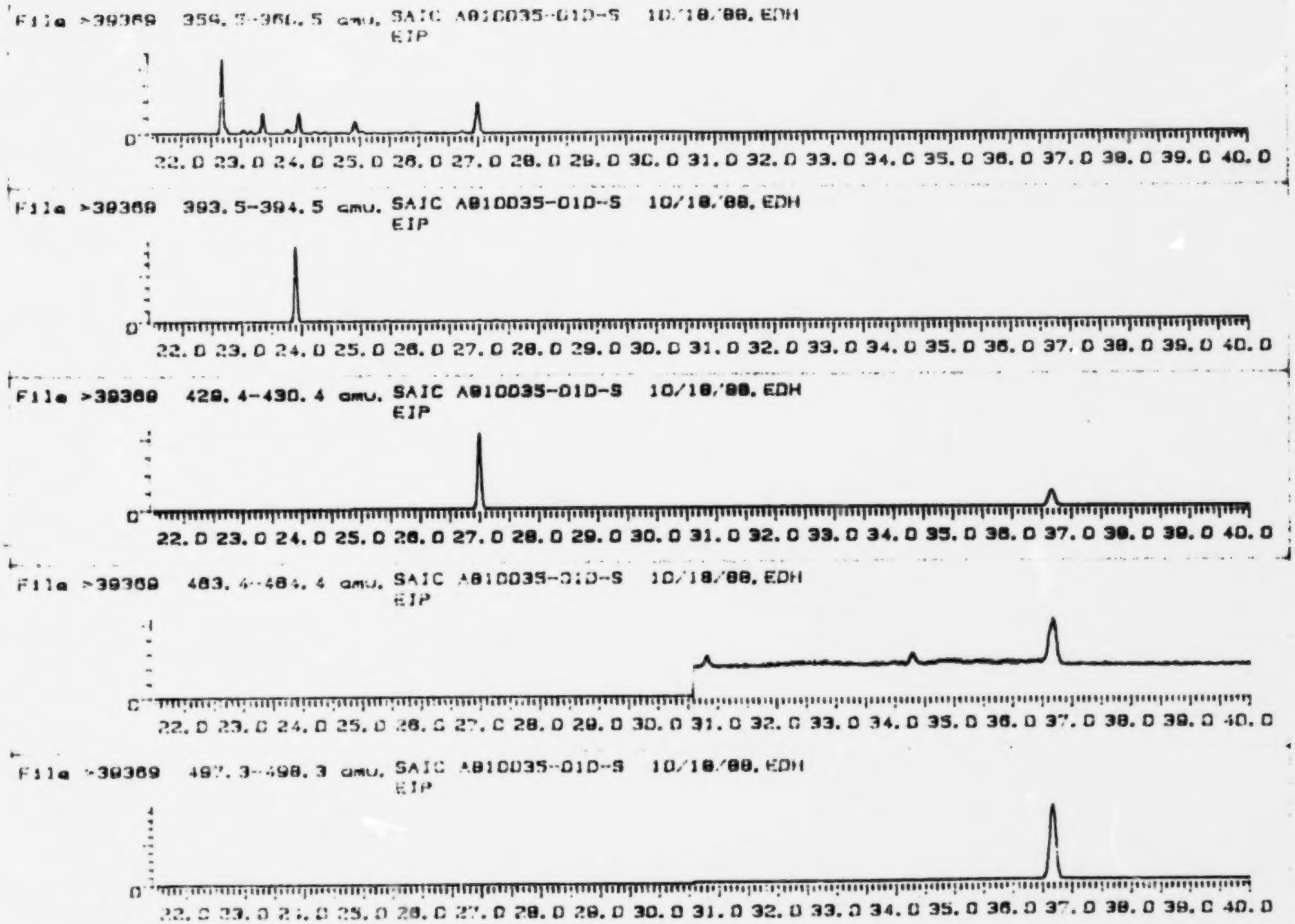


Figure 23. EICPs of Hexa- Through Deca- Isomers of Raffinate Matrix Spike Duplicate Sample.

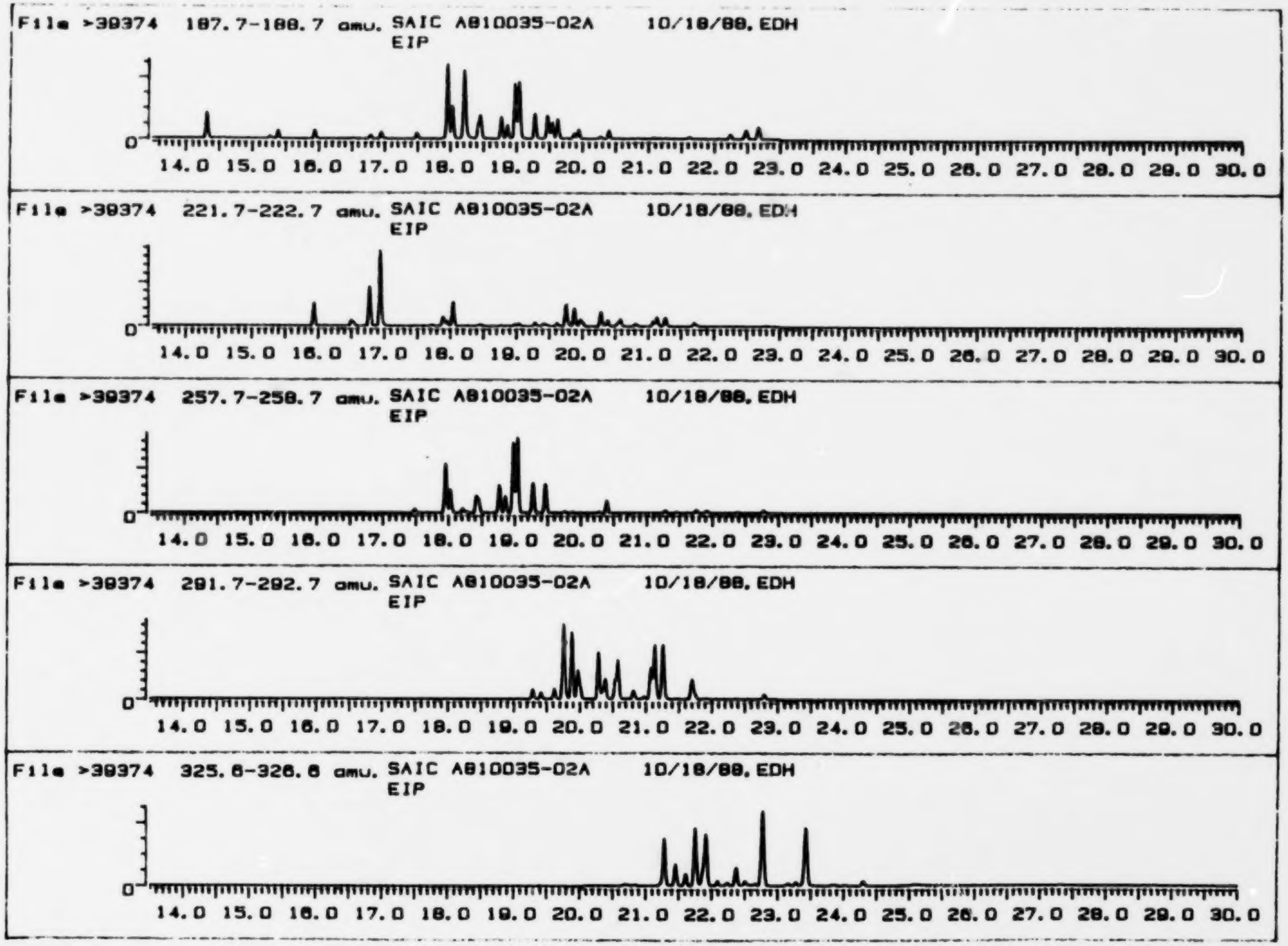


Figure 24. EICPs of Mono- Through Penta- Isomers of Extract Oil Sample.

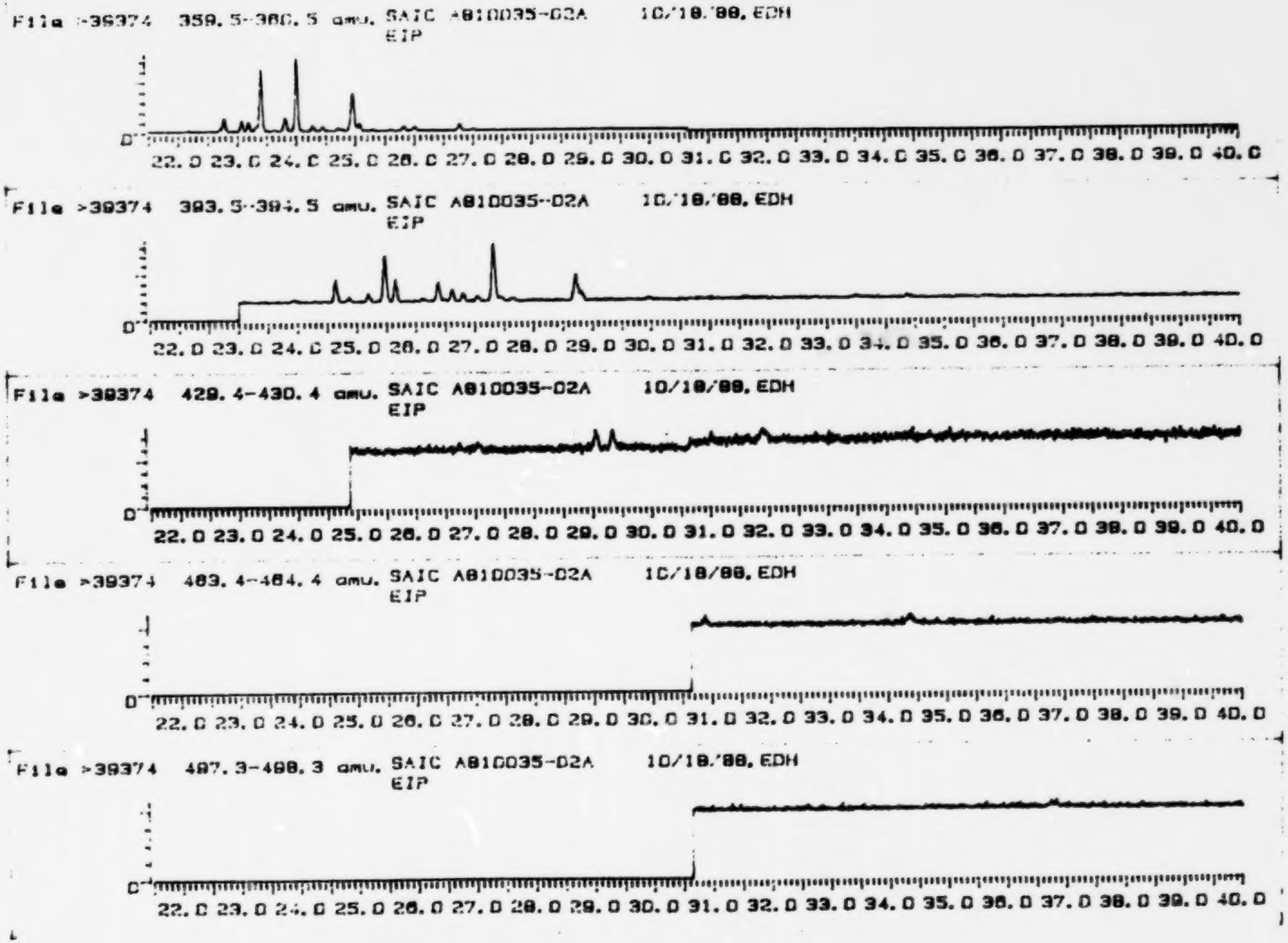


Figure 25. EICPs of Hexa- Through Deca- Isomers of Extract Oil Sample.

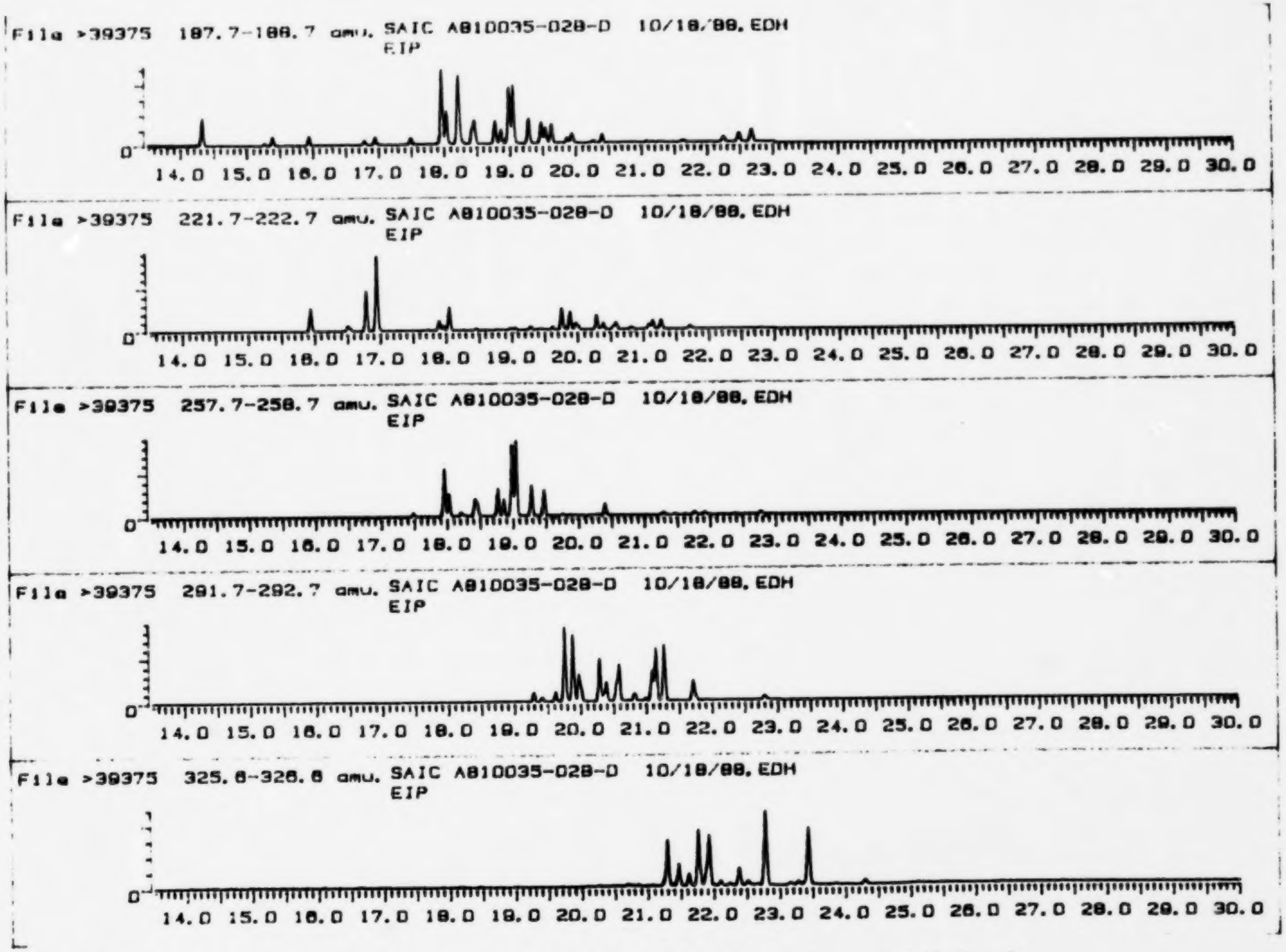


Figure 26. EICPs of Mono- Through Penta- Isomers of Duplicate Extract Oil Sample.

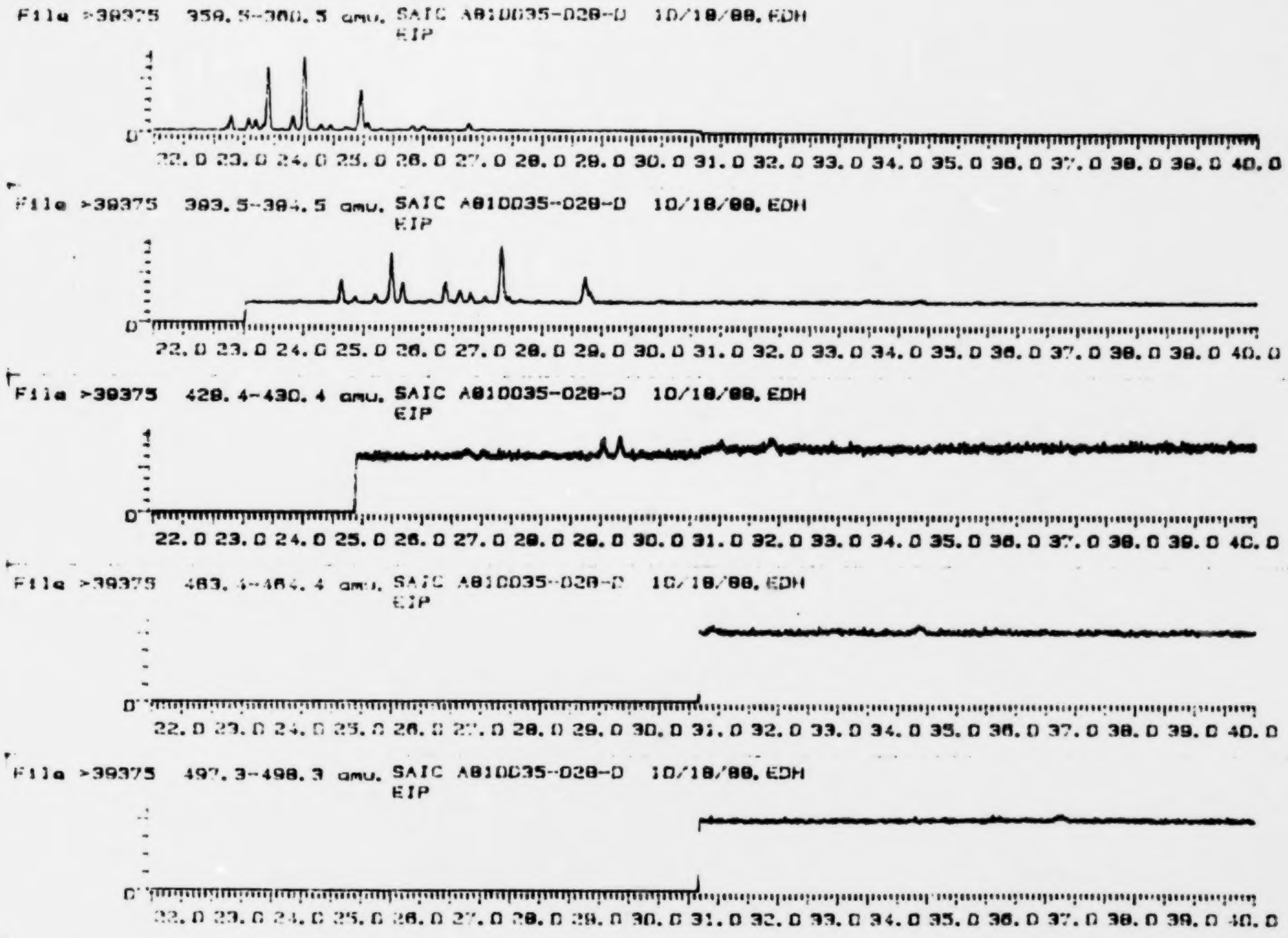


Figure 27. EICPs of Hexa- Through Deca- Isomers of Duplicate Extract Oil Sample.

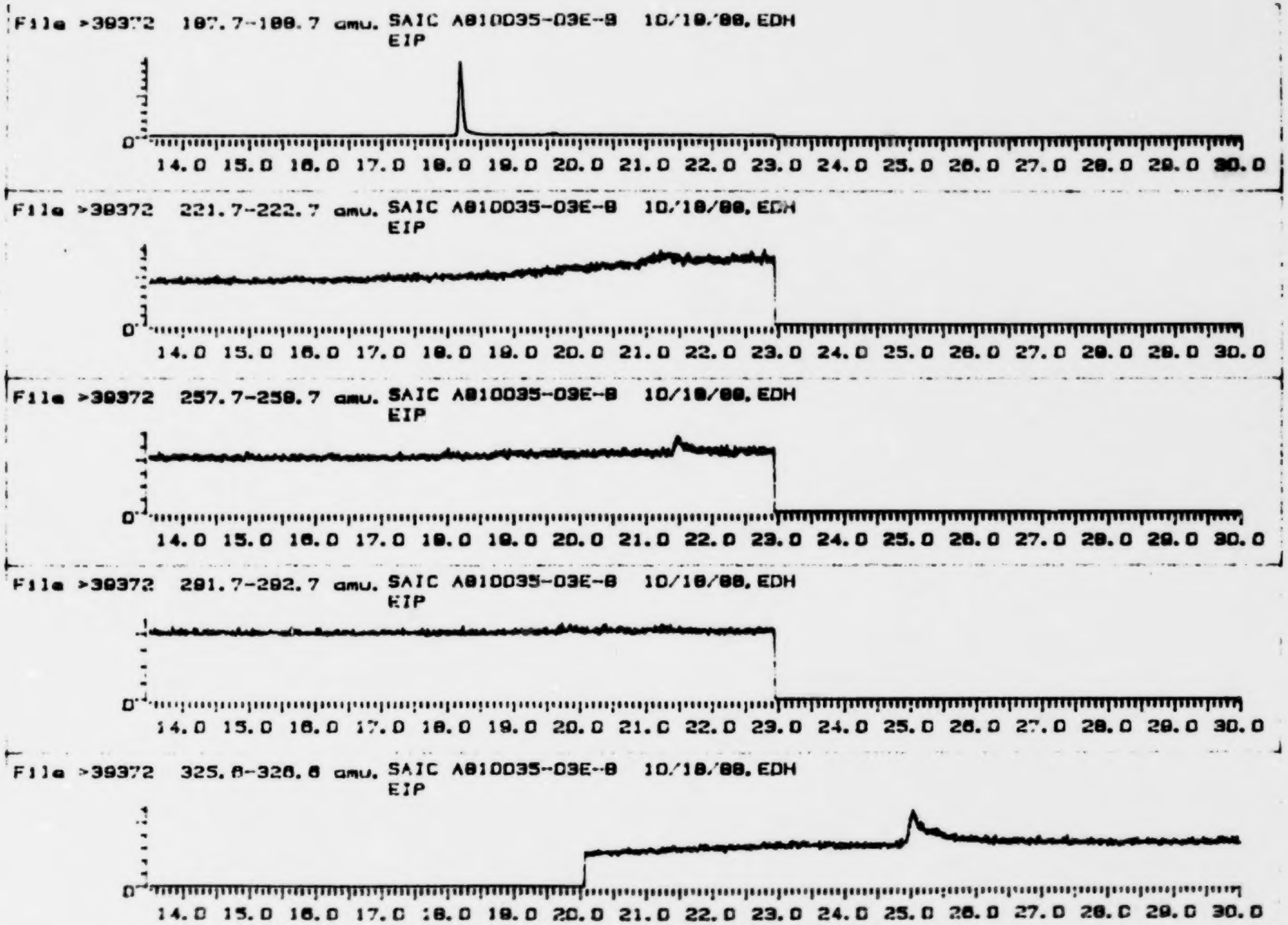


Figure 28. EICPs of Mono- Through Penta- Isomers of Reagent Blank.

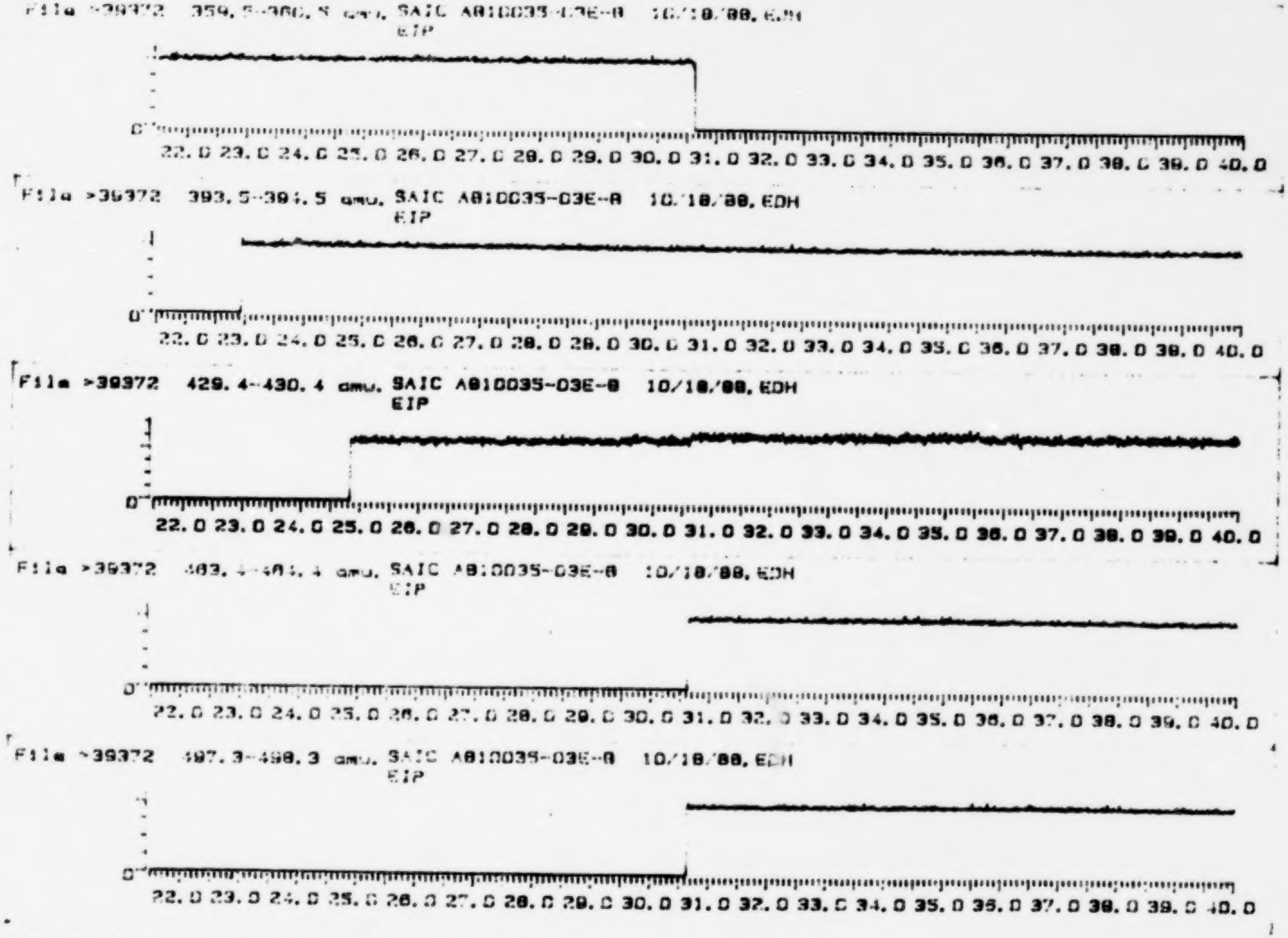


Figure 29. EICPs of Hexa- Through Deca- Isomers of Reagent Blank.

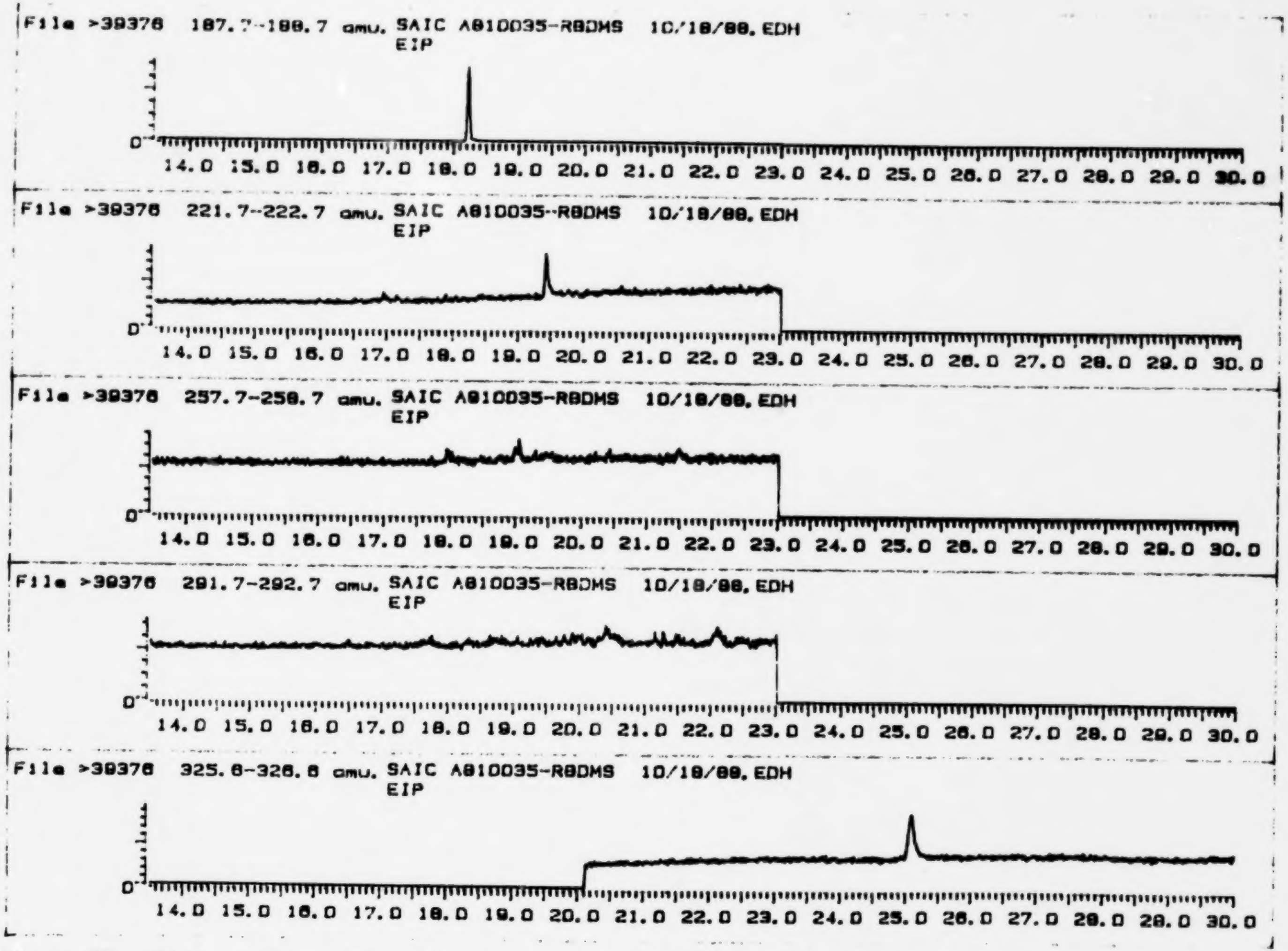


Figure 30. EICPs of Mono- Through Penta- Isomers of Reagent Blank #2.

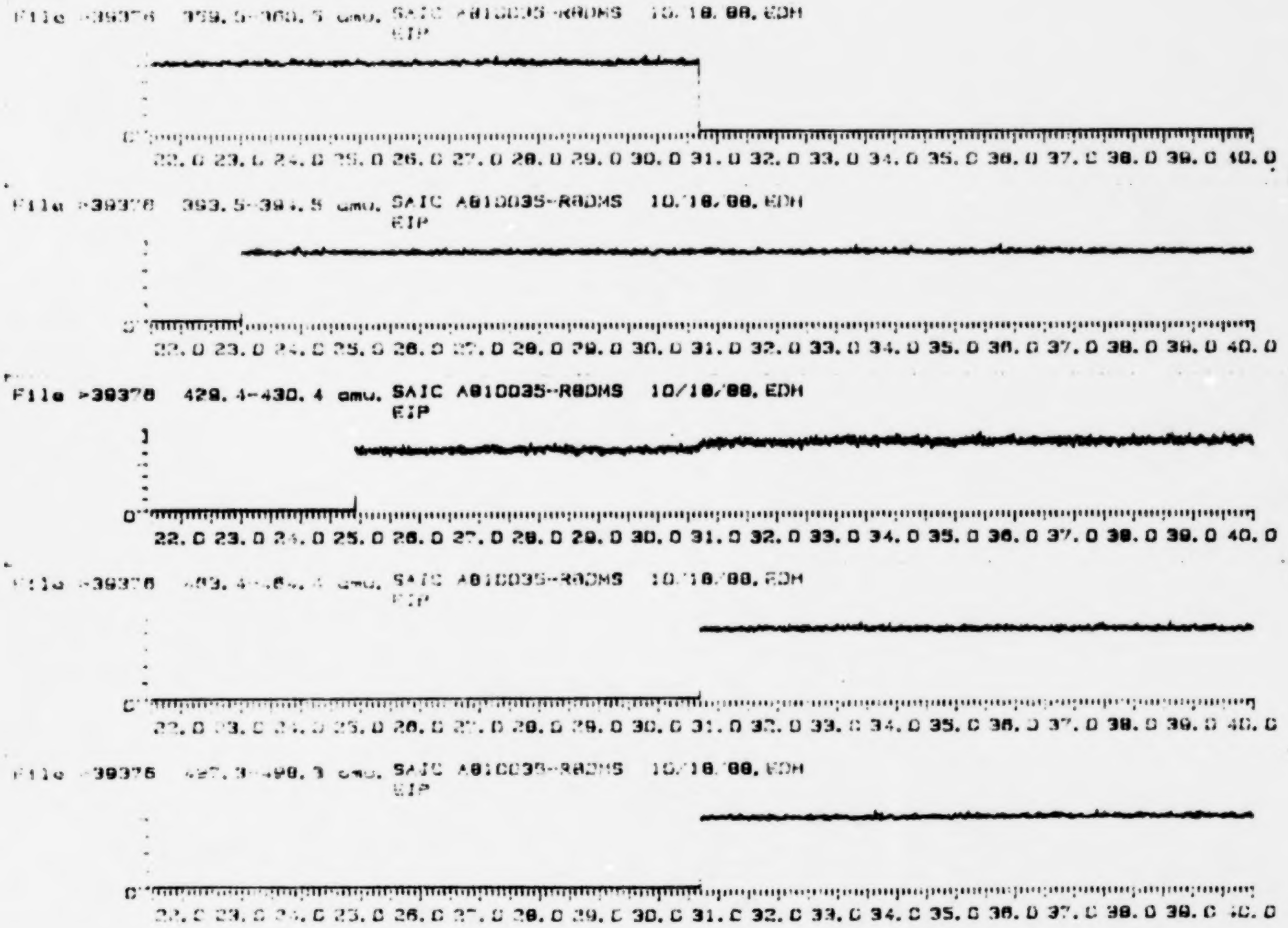


Figure 31. EICPs of Hexa- Through Deca- Isomers of Reagent Blank #2.

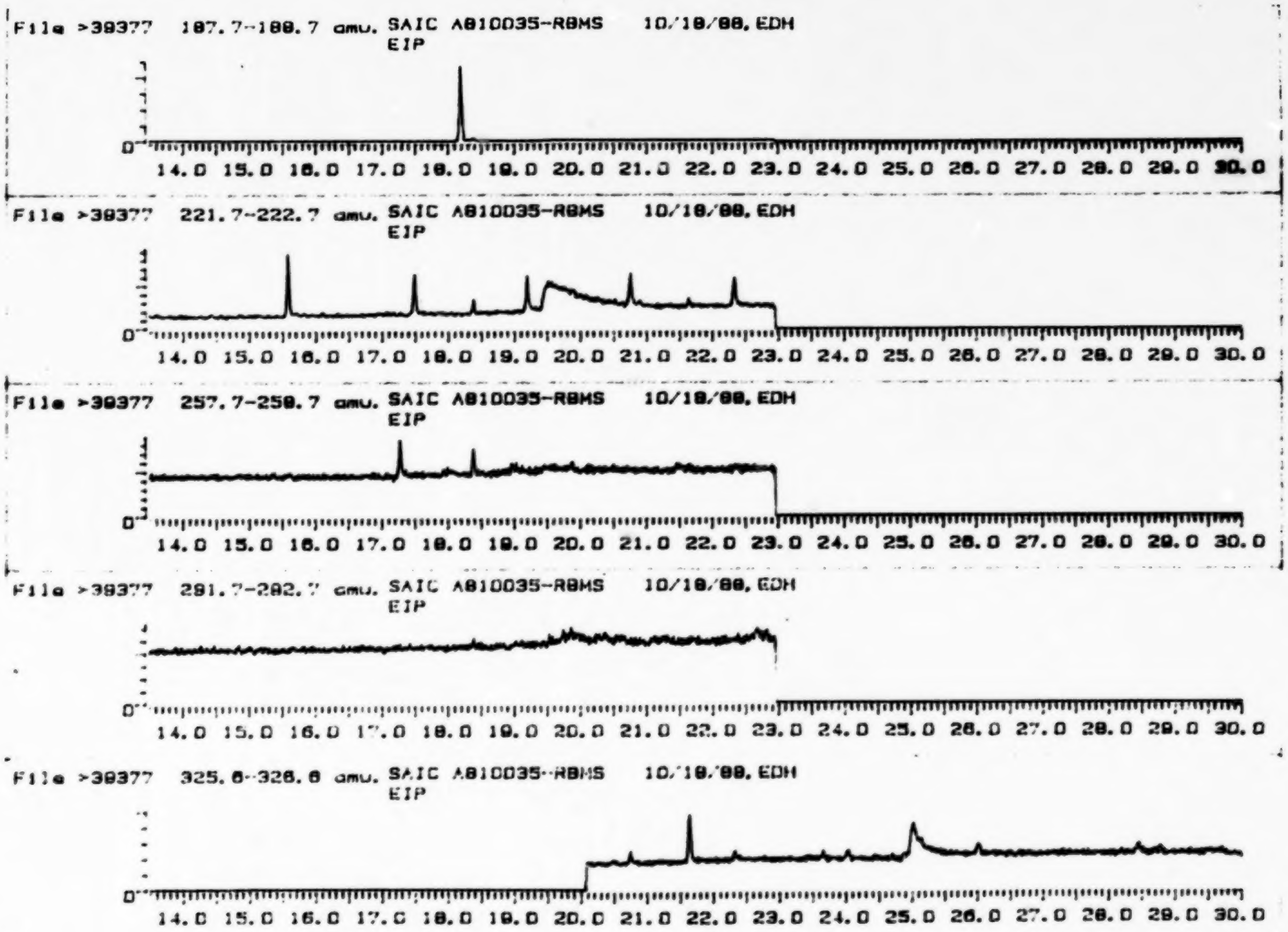


Figure 32. EICPs of Mono- Through Penta- Isomers of Reagent Blank #3.

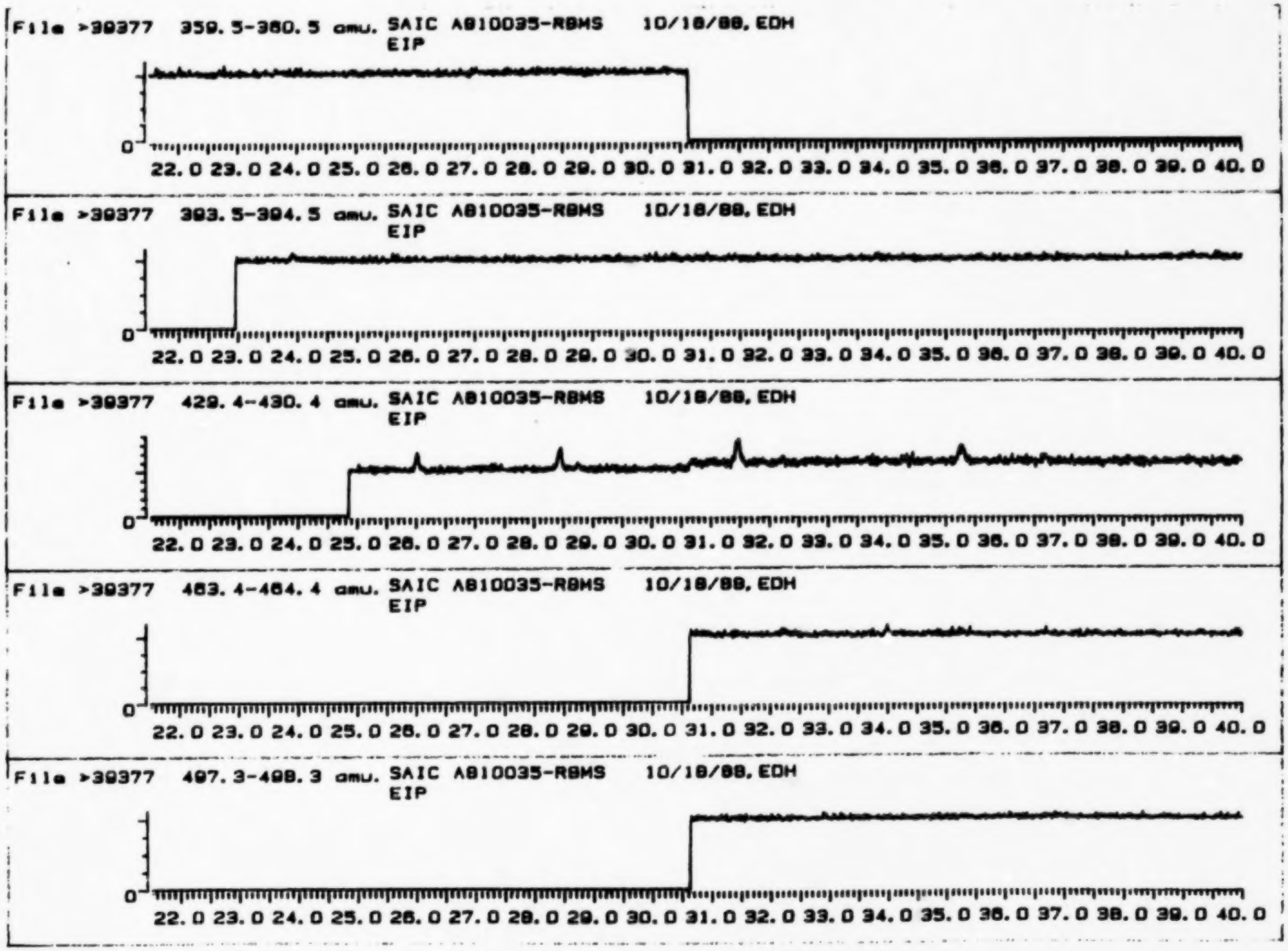


Figure 33. EICPs of Hexa- Through Deca- Isomers of Reagent Blank #3.

TABLE 4-7. SAIC PCB CONCENTRATION BY ISOMER GROUP - DEMO 4, PASS 4

	Feed		Dup Feed		Rel	Raffinate		Dup. Raffinate		Rel	Oil	Dup.	Rel
	Wet ug/g	Dry ug/g	Wet ug/g	Dry ug/g	% Diff	Wet ug/mL	Dry ug/g	Wet ug/mL	Dry ug/g	% Diff	ug/g	ug/g	% Diff
Mono-	7.1	39	7.1	39	0	0.06	0.60	0.06	0.57	5.0	60	67	11
Di-	210	1100	210	1100	0	3.0	29	3.1	30	3.3	1900	2100	10
Tri-	520	2800	520	2800	0	10	98	10	98	0	4800	5400	12
Tetra-	540	2950	550	3000	1.8	13	127	14	137	7.4	5100	5600	9.3
Penta-	250	1370	260	1420	3.9	7.1	70	7.0	69	1.4	2600	2900	11
Hexa-	49	270	47	260	4.2	1.8	18	1.8	18	0	660	730	10
Hepta-	<30	<160	<30	<160	—	0.12	1.2	0.12	1.2	0	59	62	5.0
Octa-	<30	<160	<30	<160	—	<0.07	<0.7	<0.07	<0.7	—	<28	<28	—
Nona-	<30	<160	<30	<160	—	<0.07	<0.7	<0.07	<0.7	—	<28	<28	—
Deca-	<50	<270	<50	<270	—	<0.12	<1.2	<0.12	<1.2	—	<46	<46	—
Totals	1600	8600	1600	8600	0	35	350	36	360	2.8	15000	17000	12

!

TABLE 4-8. SAIC MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY DATA FOR DEMO 4, PASS 4 - GC/MS

Isomer Group	Matrix Spike	Matrix Spike Duplicate	Rel. % Diff.
Monochlorobiphenyl	37%	32%	14
Dichlorobiphenyl	44%	38%	15
Trichlorobiphenyl	53%	48%	9.9
Tetrachlorobiphenyl	64%	59%	8.1
Pentachlorobiphenyl	73%	68%	7.1
Hexachlorobiphenyl	72%	68%	5.7
Heptachlorobiphenyl	50%	47%	6.2
Octachlorobiphenyl	58%	56%	3.5
Nonachlorobiphenyl	NS[a]	NS	NA[b]
Decachlorobiphenyl	54%	50%	7.7

[a] Not spiked.
[b] Not applicable.

TABLE 4-9. FEED, RAFFINATE AND OIL CONGENER CLASS RATIOS FOR DEMO 4, PASS 4 - GC/MS

	Feed (mean) ug/g	Raffinate (mean) ug/g	Oil (mean) ug/g	FD:RAF Ratio	FD:OIL Ratio	RAF:OIL Ratio
Mono-	39	0.58	64	66.5	0.611	0.00919
Di-	1150	30	2000	38.4	0.574	0.01495
Tri-	2800	98	5100	29.0	0.557	0.01922
Tetra-	3000	130	5400	22.5	0.557	0.02474
Penta-	1400	69	2800	20.2	0.507	0.02513
Hexa-	260	18	700	14.9	0.377	0.02539
Hepta-	ND[a]	12	61	NC[b]	NC	0.01945
Totals	8700	350	16000	24.9	0.544	0.02188

[a] Not detected.
[b] Not calculated.

TABLE 4-10. SURROGATE % RECOVERIES FOR DEMO 4, PASS 4 - GC/MS

C-13 Surrogate	Feed	Feed Dup.	Raffinate	Raff. Dup.	Oil	Oil Dup.
Mono-	66	66	61	53	74	86
Tetra-	72	71	86	80	105	115
Octa-	81	84	102	94	105	112
Deca-	96	100	131	116	145[a]	150[a]

[a] Outside QC limits.

As was described for the Demo 1 samples in Section 4.1, Table 4-11 is a listing of the tentative identification and the relative percentages of the Aroclors present in the Demo 4, Pass 4 samples. The isomer group ratio comparisons can be found on Table 4-12. As in the Demo 1 samples, there are large relative percent differences in these ratios. These data, along with the feed to raffinate, feed to oil, and raffinate to oil ratios from Table 4-9 support the conclusion that the liquid propane is extracting the lower chlorinated biphenyls more efficiently. This is further supported by the relatively higher concentrations of the lower chlorinated species found in the extract oil.

4.2.2 Method 8080 - GC/ECD

The chromatograms for all of the samples, standards and blanks run for this project are included under separate cover as Appendix B. Table 4-13 lists the amount of PCBs found in each duplicate pair of samples, reported as Aroclor 1242 (for both wet and dry weights) along with the relative percent differences (RPD) in the duplicate samples. These data show the RPD for the feed sample to be 18 percent, the raffinate 2.7 percent, and the extract oil RPD was 19 percent. Table 4-13 also reveals the surrogate recoveries for each of these analyses. The matrix spike/matrix spike duplicate recoveries are 161 and 157 percent, respectively. According to average of the duplicate analyses by GC/ECD, (dry weight determination) the liquid propane removed 96% of the PCBs (quantitated as Aroclor 1242) that were present in the feed.

4.3 Phase Three - Florisil Tubes

Air monitoring for PCBs was carried out using a modified Method P&CAM 253 with Florisil tubes. (Modifications were discussed in Section 3.2.3.) Both the front and back sections of the tubes were extracted in hexane and analyzed by GC/ECD. With the exception of sample HIRAF-02, no PCBs were found in the back sections. The actual concentration of PCBs in this sample were below the method quantification limit and therefore, are not reported. The PCBs that were detected in the fronts of the Florisil tubes did

TABLE 4-11. TENTATIVE IDENTIFICATION AND RELATIVE AMOUNTS OF AROCLORS FOR DEMO 4, PASS 4 - GC/MS[a]

	Feed	Raffinate	Oil
Aroclor 1016 and/or 1242	57%	41%	56%
Aroclor 1248	26%	39%	25%
Aroclor 1254	17%	40%	19%

[a] Estimated using the program developed by L. E. Silvon, Battelle.

TABLE 4-12. METHOD 680 ISOMER GROUP RATIO COMPARISONS FOR DEMO 4, PASS 4 - GC/MS

				Relative % Difference		
	Feed	Raffinate	Oil	Fd-Raf	Fd-Oil	Raf-Oil
Mono:Di Ratio	0.0338	0.0195	0.0318	53.6	6.28	47.8
Mono:Tri Ratio	0.0137	0.0059	0.0125	78.6	9.22	70.7
Mono:Tetra Ratio	0.0130	0.0044	0.0119	98.9	9.31	91.7
Mono:Penta Ratio	0.0278	0.0084	0.0231	107	18.7	92.9
Mono:Hexa Ratio	0.148	0.0331	0.0914	127	47.3	93.7
Mono:Hepta Ratio	NC[a]	0.496	1.05	NC	NC	71.7
Di:Tri Ratio	0.404	0.305	0.392	27.9	2.94	25.0
Di:Tetra Ratio	0.385	0.226	0.374	52.2	3.03	49.3
Di:Penta Ratio	0.824	0.433	0.727	62.2	12.4	50.8
Di:Hexa Ratio	4.38	1.69	2.88	88.3	41.3	51.8
Di:Hepta Ratio	NC	25.4	33.1	NC	NC	26.1
Tri:Tetra Ratio	0.954	0.741	0.953	25.2	0.09	25.1
Tri:Penta Ratio	2.04	1.42	1.85	35.9	9.49	26.6
Tri:Hexa Ratio	10.8	5.56	7.34	64.4	38.5	27.7
Tri:Hepta Ratio	NC	83.3	84.3	NC	NC	1.15
Tetra:Penta Ratio	2.14	1.91	1.95	11.0	9.40	1.58
Tetra:Hexa Ratio	11.4	7.50	7.70	40.9	38.4	2.60
Tetra:Hepta Ratio	NC	113	88.4	NC	NC	24.0
Penta:Hexa Ratio	5.31	3.92	3.96	30.2	29.3	1.02
Penta:Hepta Ratio	NC	58.8	45.5	NC	NC	25.5
Hexa:Hepta Ratio	NC	15.0	11.5	NC	NC	26.5

[a] Not calculable.

TABLE 4-13. SAIC 8080 DATA IN ug/g BY AROCLOR (ASSUMING 100% AROCLOR 1242) FOR DEMO 4, GC/ECD

	FEED		DUP FEED		Rel % Diff.	RAFFINATE		DUP RAFF.		Rel % Diff.	OIL	DUP OIL	Rel % Diff.
	Wet	Dry	Wet	Dry		Wet	Dry	Wet	Dry				
	1800	9836	1500	8197	18.2	36	353	37	363	2.7	17000	14000	19.4
Mean	1650	9016				36.5	358				15500		
Surrogate Recoveries (%)													
DBC	91		96			92		86			119	93	
TCMX	106		104			104		97			135	109	

not display a typical Aroclor pattern. The results shown in Table 4-14 are reported assuming that the PCBs are present as Aroclor 1242. The perchlorination data are also reported here. The matrix spike and matrix spike duplicate tubes were spiked with Aroclor 1242 and revealed recoveries of 105 and 97% respectively. The surrogate recoveries of TCMX ranged from 87 to 106%. The recoveries of the DBC were 1 to 9%. Since this method does not call for the use of any surrogates, there are no acceptance criteria for these recoveries. However, the excellent recoveries of the TCMX are very representative of the MS/MSD recoveries. TCMX is recommended as the only surrogate for future Florisil tube studies.

4.4 Phase Four - Analysis of EC Jordan Sample Extract

4.4.1 Method 680 - GC/MS

The total ion current (TIC) chromatograms of the EC Jordan sample extract (with and without acid wash) are included as Figure 34. The extracted ion current profile (EICP) chromatograms for the major ion of each isomer class, dichlorobiphenyl through decachlorobiphenyl, are included as Figures 35 through 38. Table 4-15 lists the amount of PCBs found in each sample by isomer class assuming a 30 gram sample (that was 13 percent solids) was extracted and then concentrated to 20 mL. Nineteen mL of the extract was used for the semivolatile analysis by EC Jordan and the remaining one mL was used for the PCB analysis. The extract received by Radian contained 720 uL of hexane. There was no way to determine how much of the missing 280 uL was due to concentration and how much was removed for analysis by EC Jordan. Consequently, the assumption was made that all of the missing sample was removed for analysis, and there was no solvent evaporation. All of the concentrations are calculated based on a 1.5 gram/mL sample size.

4.4.2 Method 8080 - GC/ECD

The chromatograms for the EC Jordan extracts are also included under separate cover as Appendix B. Analysis of the extract revealed a total Aroclor concentration of 4100 ppm in the untreated extract and 3400 ppm in the acid washed fraction on a dry weight determination. These data are listed on Table 4-16.

TABLE 4-14. SAIC FLORISIL TUBE DATA

Sample	PCB-1242 PCB-1242 (Total ug)	DBC Recovery	TCMX Recovery	P&CAM Conc. (Total ug)
HIRAF-01	0.47	NS[a]	NS	0.45
HIRAF-02	0.87	NS	NS	0.66
HIRAF-03	0.78	NS	NS	0.66
HIRAF-03 Dup	0.75	NS	NS	—
HIRAF-04	0.25	NS	NS	0.2
Trip Blank	ND[a]	NS	NS	—
F923-A1	0.16	NS	NS	0.15
F923-A2	0.23	NS	NS	0.21
Trip Blank	ND	NS	NS	—
WDE0988-0	0.54	2%	104%	0.39
WDE0988-0	ND	4%	106%	—
F923-P1	ND	8%	105%	—
T927-01	ND	1%	87%	—
T927-01 Dup	ND	1%	93%	—
T928-A1	ND	9%	96%	—
Trip Blank	ND	2%	99%	—

---

[a] Not spiked.

[b] Not detected.

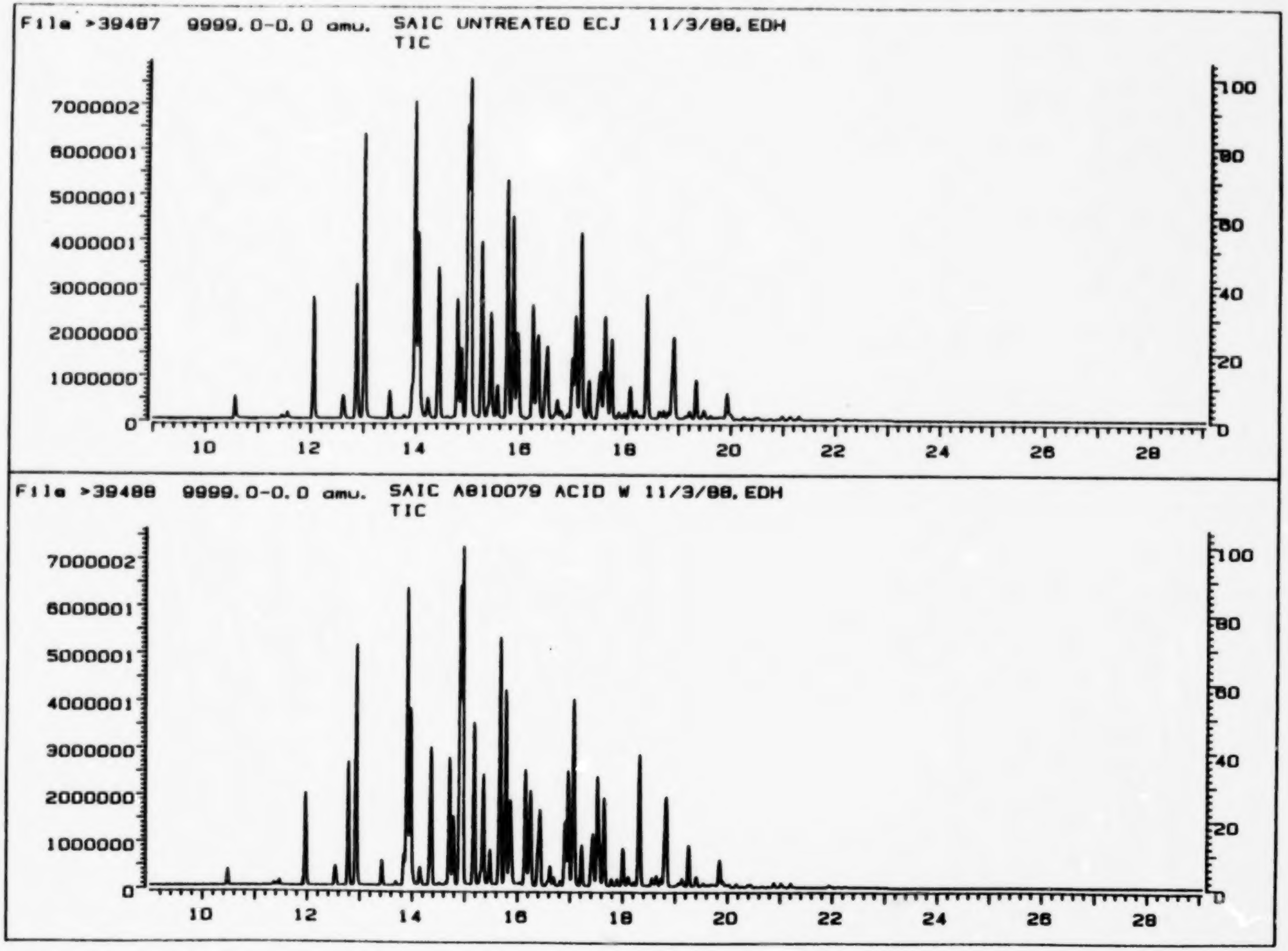


Figure 34. TIC of EC Jordan Sample Extract, With (above) and Without (below), and Clean-up.

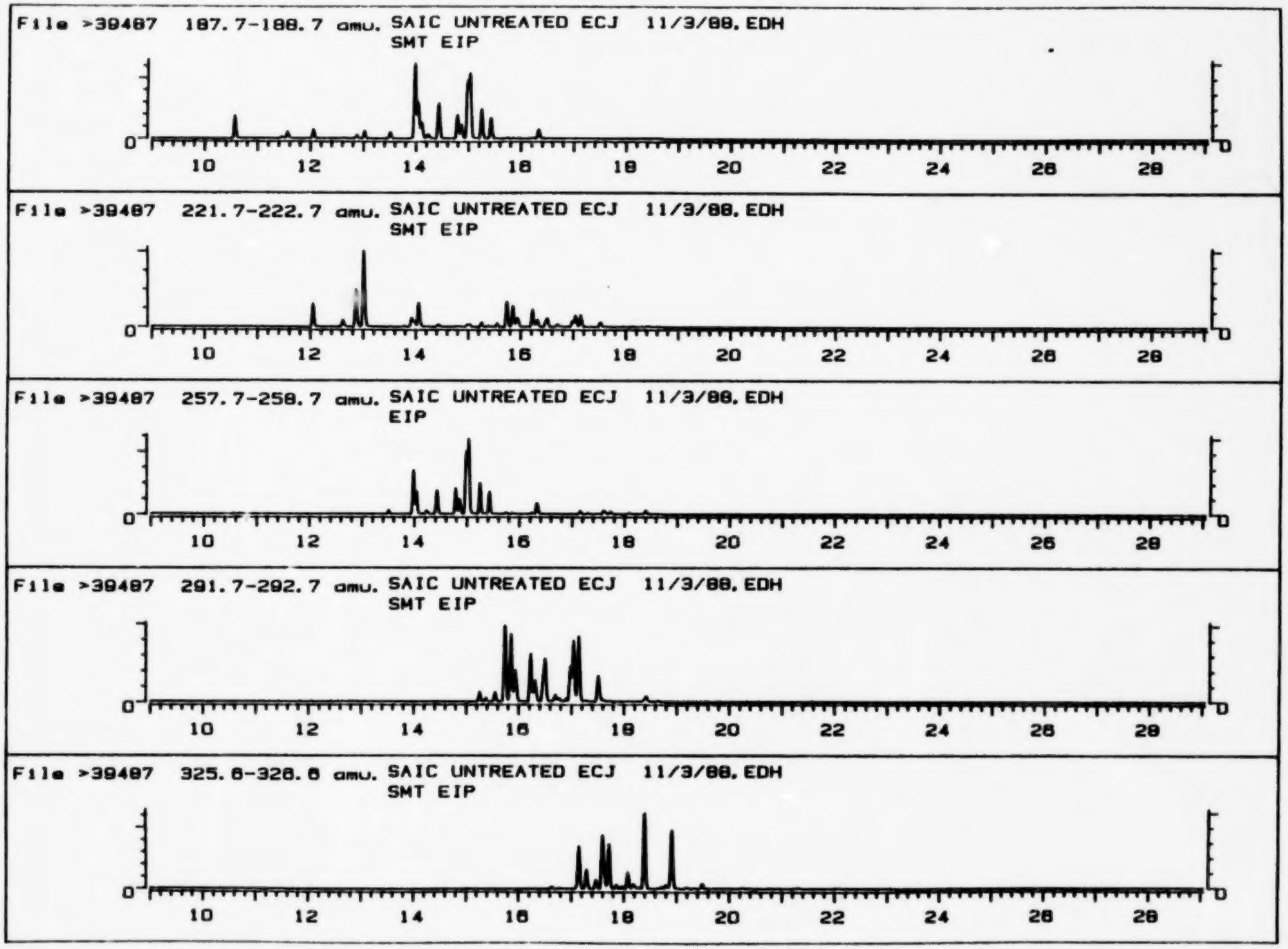


Figure 35. EICPs, of Mono- Through Penta- Isomers of EC Jordan Extract, Untreated.

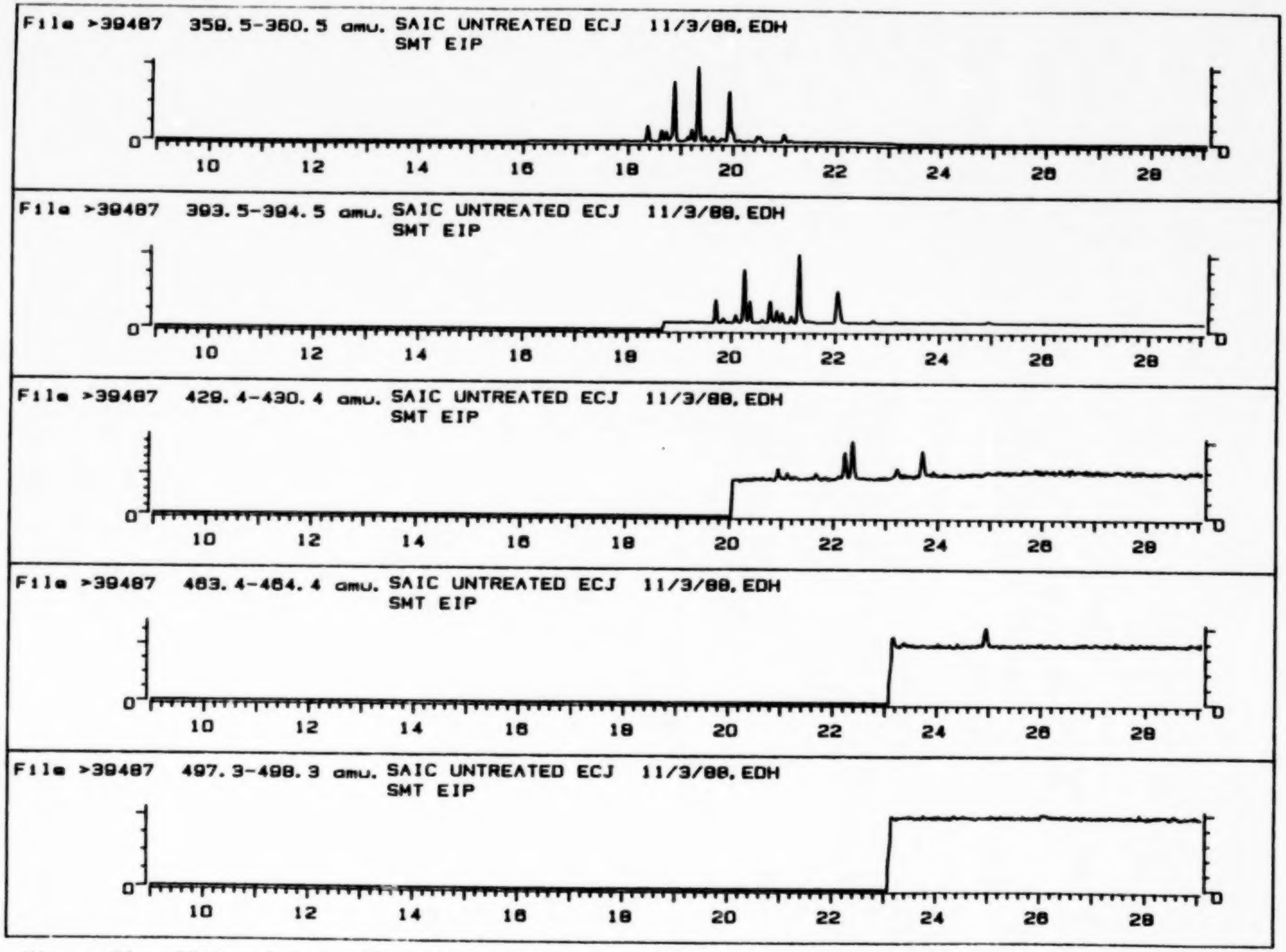


Figure 36. EICPs of Hexa- Through Deca- Isomers of EC Jordan Extract, Untreated.

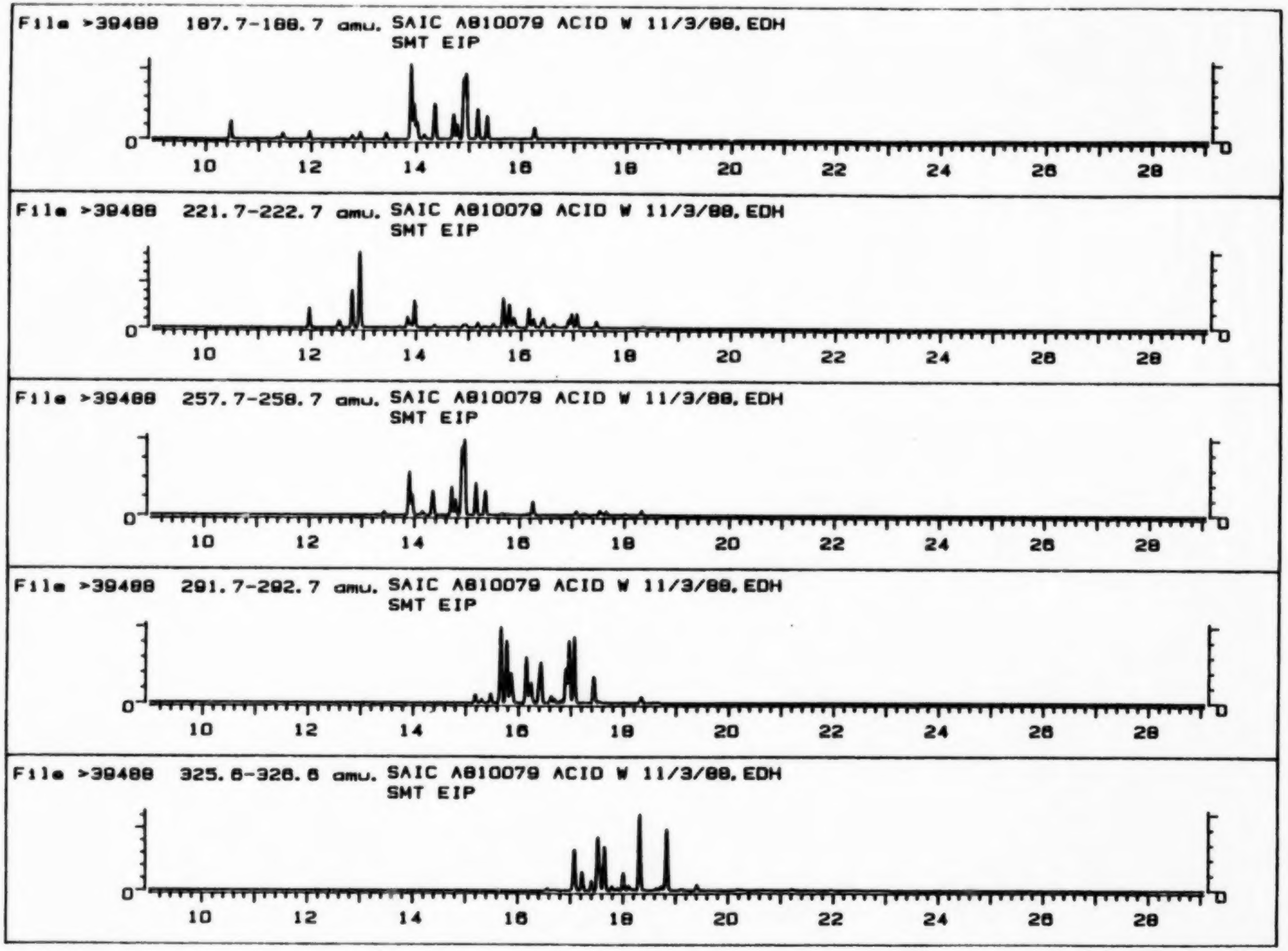


Figure 37. EICPs of Mono- Through Penta- Isomers of EC Jordan Extract, Acid Washed.

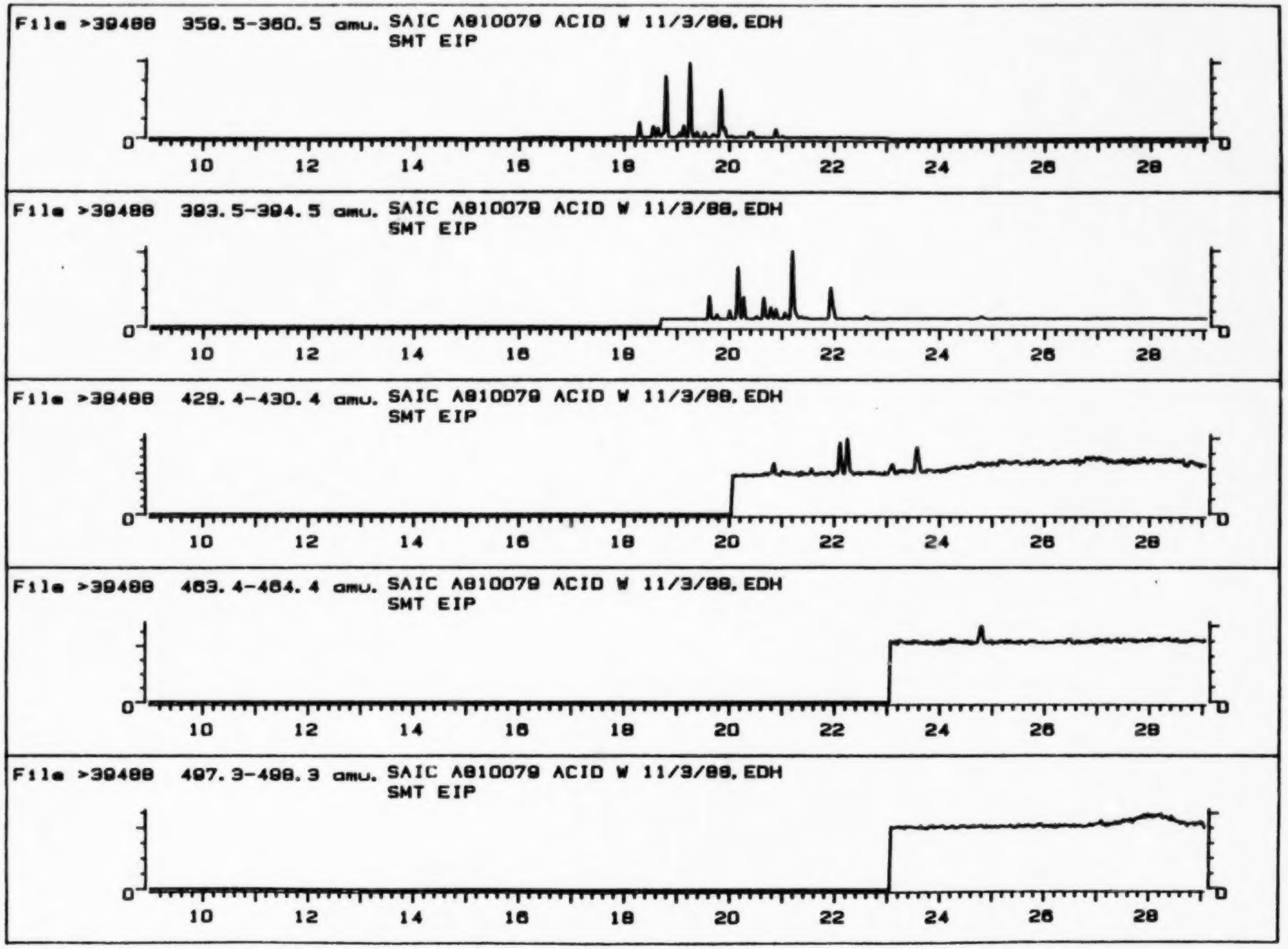


Figure 38. EICPs of Hexa- Through Deca- Isomers of EC Jordan Extract, Acid Washed.

TABLE 4-15. EC JORDAN EXTRACT PCB CONCENTRATION BY ISOMER CLASS (ug/g)

	EC Jordan Sample Extract				Rel
	As Received		Acid Washed		%
	Wet	Dry	Wet	Dry	Diff
Mono-	2.0	16	1.6	12	26
Di-	60	460	57	440	6.1
Tri-	160	1300	170	1300	0.8
Tetra-	200	1500	210	1600	6.2
Penta-	94	720	100	800	10
Hexa-	26	200	29	220	9.4
Hepta-	2.8	22	3.0	23	7.1
Octa-	0.3	2.6	0.4	3.3	24
Nona-	<0.3	<2.6	<0.3	<2.6	—
Deca-	<0.3	<2.6	<0.3	<2.6	—
Totals	550	4200	570	4400	4.1

TABLE 4-16. EC JORDAN SAMPLE EXTRACT 8080 DATA IN ug/g BY AROCLOR

	Reagent Blank	EC Jordan Extract As Received Wet	Dry	Acid Washed Wet	Dry	Rel % Diff.
PCB-1242	ND[a]	390	3000	320	2500	19.3
PCB-1254	ND	140	1000	120	910	13.6
PCB-1260	ND	12	91	10	74	21.0
Totals	ND	540	4100	450	3400	17.8
Surrogate Recoveries (%)						
DBC	100		106		85	
TCMX	93		126		88	

[a] Not detected.

5.0 CONCLUSIONS

For the GC/ECD analysis, assignments of Aroclor compositions to the extracts of the raffinate, extract oil and Florisil samples were complicated by the modification of the PCB pattern from the original isomer distribution. Since it is apparent from the mass spectral data that the lower chlorinated isomers of the PCBs are more efficiently extracted from the feed by the liquid propane, the raffinate samples displayed a pattern of PCBs that is apparently enriched in the higher chlorinated species. The extract oil samples were enriched in the lower chlorinated isomers. Analysis of the Florisil tubes revealed an even larger distortion of the original Aroclor pattern, probably due to the differences in volatility of the individual isomer groups. Due to this distortion, it was necessary to perform the perchlorination procedure on the Florisil tube samples. Quantification of PCBs by level of chlorination avoids this difficulty in assignment of composition and has the potential for generating more efficient and reliable data on PCB contaminated samples. However, if perchlorination will be used for any future studies, it is recommended that the modifications discussed in this report are followed, and TCMX is used as a surrogate standard.

The Demo 4, Pass 4 sample analyses revealed excellent precision both between the sample duplicates (mean 9.2 RPD) and between the two methods (mean 3.1 RPD). In the Demo 4 test, both the mass spectral analysis and the GC/ECD analysis indicated a 96% removal efficiency of the available PCBs. In the Demo 1 test, the liquid propane removed 70 percent of the available PCBs.

Although the analysis of these samples by isomer group reveals that there is a preferential extraction of the lower chlorinated PCB isomers by the liquid propane, this biasing is most pronounced in the extreme lower and upper levels of chlorination. Since the New Bedford Harbor is well characterized to contain mostly Tri- through Penta- isomers, it appears that analysis by Method 8080 (GC/ECD) is sufficient, and the preferential removal of the lower chlorinated isomers will not significantly affect the data. However, the

Florisil tubes or treated samples and future studies to determine the PCB concentrations in a matrix that has been subjected to a thermal or chemical treatment, quantification by isomer group or the perchlorination procedure must be considered. In addition, if the samples that are to be treated are not as well characterized as they are at this site, Method 680 should be employed to see if Method 8080 is a reasonable method to estimate the PCBs present.

OPERATING LOG DATA

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/ 8/88	2	1	1443 <-- START				10.00				666.5				
			1453	252	243	76	12.00	0.910	18.0	2.0		70	78	45	5.3
			1503	275	247	76	14.00	0.860	2.4	0.3		71	83	43	5.6
			1513	265	235	76	15.75	0.700	4.5	0.6		70	84	44	5.4
			1523	238	237	76	18.25	1.000	2.0	0.2		71	84	42	5.7
			1533	240	232	76	20.50	0.740	0.0	0.0		71	84	42	5.7
			1543	243	239	76	24.50	1.160	5.6	0.5		71	84	42	5.7
			1551 <--END								782.0				
			Mean:	252	239	76		0.9	5.4	0.6		71	83	43	5.6
			Maximum:	275	247	76		1.2	18.0	2.0		71	84	45	5.7
			Minimum:	238	232	76		0.7	0.0	0.0		70	78	42	5.3
			Net Change:								115.5				

Feed Temperature: * deg F

Viscosity: 170 cP

pH: *

Run Time: 68 min

* Lost Data

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/12/88	2	2	1307 <-- START				12.75				831.5				
			1317	275	238	70	15.00	0.9	5.6	0.6		69	81	46	5.2
			1327	255	211	70	17.00	0.8	12.5	1.7		69	82	49	4.9
			1337	218	218	70	19.50	0.9	11.5	1.3		70	83	49	4.9
			1347	217	217	71	22.25	0.8	18.0	2.4		70	82	49	4.9
			1357	210	210	70	27.50	0.9	17.9	2.1		70	82	49	4.9
			1359 <--END								856.0				
			Mean:	235	219	70		0.9	13.1	1.6		70	82	48	4.9
			Maximum:	275	238	71		0.9	18.0	2.4		70	83	49	5.2
			Minimum:	210	210	70		0.8	5.6	0.6		69	81	46	4.9
			Net Change:								24.5				

Feed Temperature: 64 deg F   Viscosity: 40 cP   pH:7.89

Run Time: 52 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/13/88	2	3	1202 <-- START				13.00				1006.5				
			1212	260	235	67	16.00	1.2	11.7	1.0		69	72	45	5.3
			1224	260	230	70	19.50	1.1	16.4	1.5		70	79	43	5.6
			1232	235	222	72	22.00	0.9	16.3	1.9		70	81	44	5.4
			1242	245	220	73	26.50	0.9	6.9	0.8		70	79	44	5.4
			1248 <--END								1025.0				
Mean:				250	227	71		1.0	12.8	1.3		70	78	44	5.4
Maximum:				260	235	73		1.2	16.4	1.9		70	81	45	5.6
Minimum:				235	220	67		0.9	6.9	0.8		69	72	43	5.3
Net Change:											18.5				

Feed Temperature: 61 deg F Viscosity: 40 cP pH:8.4

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/14/88	2	4	1238 <-- START				12.75				1209.0				
			1248	265	245	*	15.25	1.0	19.4	2.1		68	77	41	5.8
			1258	270	235	*	17.00	0.7	8.7	1.4		69	81	41	5.8
			1308	255	240	70	19.75	1.0	20.0	2.2		69	82	42	5.7
			1318	245	240	70	23.00	0.9	4.1	0.5		68	83	41	5.8
			1328	274	240	70	**		14.9			69	82	41	5.8
			1331 <--END								1212.5				
			Mean:	262	240	70		0.9	13.4	1.5		69	81	34	5.8
			Maximum:	274	245	70		1.0	20.0	2.2		69	83	42	5.8
			Minimum:	245	235	70		0.7	4.1	0.5		68	77	41	5.7
			Net Change:								3.5				

Feed Temperature: 63 deg F

Viscosity: 30 cP

pH: 8.34

Run Time: 53 min

* Incorrect gage read

** Water added to feed kettle

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/14/88	2	5	1754 <-- START				13.00				1316.5				
			1804	275	230	76	15.50	1.0	5.4	0.6		69	78	41	5.8
			1814	250	229	79	18.00	1.0	9.3	1.1		67	78	41	5.8
			1824	232	224	87	21.00	1.4	6.6	0.6		67	79	41	5.8
			1834	222	218	90	24.00	0.9	18.3	2.5		67	78	41	5.8
			1843 <--END								1336.5				
			Mean:	245	225	83		1.1	9.9	1.2		68	78	41	5.8
			Maximum:	275	230	90		1.4	18.3	2.5		69	79	41	5.8
			Minimum:	222	218	76		0.9	5.4	0.6		67	78	41	5.8
			Net Change:								20				

Feed Temperature: 64 deg F

Viscosity: 25 cP

pH: 8.46

Run Time: 49 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/15/88	2	6	934 <-- START				13.50				1407.5				
			944	268	220	64	16.50	1.2	9.5	0.9		67	77	41	5.8
			954	210	192	60	18.00	0.6	8.7	1.6		66	76	41	5.8
			1004	190	189	60	21.50	1.1	11.2	1.1		67	77	43	5.6
			1014	271	250	60	25.75	1.0	13.3	1.5		68	77	43	5.6
			1020 <--END								1427.0	67	78	43	5.6
			Mean:	235	213	61		1.0	10.7	1.3		67	77	42	5.7
			Maximum:	271	250	64		1.2	13.3	1.6		68	78	43	5.8
			Minimum:	190	189	60		0.6	8.7	0.9		66	76	41	5.6
			Net Change:								19.5				

Feed Temperature: 45 deg F   Viscosity: <25 cP   pH: 8.27

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 g
9/15/88	2	7	1338 <-- START				15.00				1593.5			
			1348	255	230	64	18.00	1.2	16.8	1.7		67	75	42
			1358	250	234	62	20.50	0.8	10.4	1.5		67	76	41
			1408	253	232	64	24.00	1.0	3.7	0.4		66	79	39
			1417 <--END								1611.5			
			Mean:	253	232	63		1.0	10.3	1.2		67	77	41
			Maximum:	255	234	64		1.2	16.8	1.7		67	79	42
			Minimum:	250	230	62		0.8	3.7	0.4		66	75	39
			Net Change:								18			

Feed Temperature: 46 deg F Viscosity: <25 cP pH: 8.28

Run Time: 39 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 g
9/15/88	2	8	1808 <-- START				13.25				1608.0			
			1818	260	235	62	16.00	1.1	21.0	2.4		67	74	45
			1828	245	230	61	18.00	0.8	14.8	2.4		66	75	39
			1838	251	230	60	20.50	0.8	6.3	1.0		66	76	39
			1848	245	230	60	24.00	1.0	5.4	0.7		67	76	39
			1857 <--END								1628.0			
			Mean:	250	231	61		0.9	11.9	1.6		67	75	41
			Maximum:	260	235	62		1.1	21.0	2.4		67	76	45
			Minimum:	245	230	60		0.8	5.4	0.7		66	74	39
			Net Change:				10.75				20			

Feed Temperature: 52 deg F　　Viscosity: 55 cP　　pH: 8.31

Run Time: 49 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 g
9/16/88	2	9	934 <-- START				12.50				1696.5			
			944	263	240	57	15.00	1.0	14.4	1.6		65	74	39
			954	262	240	57	17.00	0.8	16.5	2.3		65	76	40
			1004	254	238	57	19.25	0.9	11.3	1.5		66	78	41
			1014	252	234	57	22.00	0.8	10.5	1.5		66	78	42
			1024	247	234	58	27.00	1.0	0.0	0.0		67	78	42
			1027 <--END								1718.6			
			Mean:	256	237	57		0.9	10.5	1.4		66	77	41
			Maximum:	263	240	58		1.0	16.5	2.3		67	78	42
			Minimum:	247	234	57		0.8	0.0	0.0		65	74	39
			Net Change:								22.1			

Feed Temperature: 43 deg F   Viscosity: <25 cP   pH: 8.03

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/16/88	2	10	1343 <-- START				12.50				1773.0				
			1353	280	238	64	14.75	0.9	13.0	1.6		67	74	39	6.1
			1403	263	244	66	16.75	0.8	8.8	1.2		67	80	40	6.0
			1413	254	231	65	19.00	0.9	2.0	0.2		68	81	39	6.1
			1423	240	225	65	22.50	1.0	13.4	1.5		67	81	39	6.1
			1433	257	227	66	25.50	0.7	3.5	0.6		67	80	39	6.1
			1440 <--END								1795.1				
			Mean:	259	233	65		0.9	8.1	1.0		67	79	39	6.1
			Maximum:	280	244	66		1.0	13.4	1.6		68	81	40	6.1
			Minimum:	240	225	64		0.7	2.0	0.2		67	74	39	6.0
			Net Change:								22.1				

Feed Temperature: 46 deg F　　Viscosity: <25 cP　　pH: 8.18

Run Time: 57 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/17/88	3	1	1245 <-- START				10.50				1915.0				
			1255	257	250	70	12.75	1.0	14.0	1.4		66	74	41	5.8
			1305	255	241	70	14.75	0.8	15.0	1.9		66	79	42	5.6
			1315	230	215	70	16.50	0.7	10.0	1.4		66	78	41	5.8
			1325	251	241	70	19.00	1.0	8.2	0.8		66	79	42	5.7
			1335	262	234	70	21.75	0.8	0.0	0.0		66	79	42	5.6
			1345	233	230	70	25.50	0.9	5.1	0.6		66	79	42	5.7
			1356	260	240	70	*								
			1356 <--END								1943.0	66	79	41	5.8
			Mean:	250	236	70		0.9	8.7	1.0		66	78	42	5.7
			Maximum:	262	250	70		1.0	15.0	1.9		66	79	42	5.8
			Minimum:	230	215	70		0.7	0.0	0.0		66	74	41	5.6
			Net Change:								28				

Feed Temperature: 70 deg F

Viscosity: 55 cP

pH: 7.80

Run Time: 71 min

* Water added to feed kettle

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/18/88	3	2	1057 <-- START				7.75				2086.0				
			1107	285	250	67	10.50	1.3	9.3	0.8		66	78	42	5.8
			1117	274	240	67	12.50	0.9	12.8	1.6		66	77	42	5.7
			1127	210	205	67	14.25	0.7	10.4	1.6		66	78	42	5.7
			1137	230	228	67	17.00	1.1	9.3	1.0		66	77	43	5.5
			1147	242	236	68	18.50	0.6	2.5	0.5		66	79	42	5.7
			1200	223	223	69	22.50	0.9	13.6	1.7		65	78	42	5.7
			1207	235	235	69	24.00	0.6	6.6	1.2		66	79	41	5.8
			1213 <--END								2116.0				
			Mean:	243	231	68		0.9	9.2	1.2		66	78	42	5.7
			Maximum:	285	250	69		1.3	13.6	1.7		66	79	43	5.5
			Minimum:	210	205	67		0.6	2.5	0.5		65	77	41	5.8
			Net Change:								30				

Feed Temperature: 60 deg F

Viscosity: 30 cP

pH: 8.31

Run Time: 76 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/19/88	3	3	1057 <-- START				13.00				2231.0				
			1107	223	216	79	15.50	1.0	9.4	1.1		67	81	40	6.0
			1117	231	231	79	18.00	1.0	12.2	1.4		67	81	41	5.8
			1127	267	240	79	20.00	0.7	0.0	0.0		67	79	41	5.8
			1137	250	233	79	22.50	0.7	10.3	1.7		67	80	41	5.8
			1143 <--END								2259.0				
			Mean:	243	230	79		0.9	8.0	1.0		67	80	41	5.9
			Maximum:	267	240	79		1.0	12.2	1.7		67	81	41	6.0
			Minimum:	223	216	79		0.7	0.0	0.0		67	79	40	5.8
			Net Change:								28				

Feed Temperature: 64 deg F Viscosity: 25 cP pH: 7.4

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/20/88	4	1	1201 <-- START				14.50				2417.5				
			1211	270	216	72	17.00	1.0	21.0	2.5		67	74	40	6.0
			1222	223	213	72	20.00	1.0	14.1	1.7		66	78	40	6.0
			1231	266	231	72	22.25	0.8	5.1	0.8		66	78	41	5.8
			1241	237	235	72	*		5.0			66	79	41	5.8
			1246 <--END								2435.0				
Mean:				249	224	72		0.9	11.3	1.7		66	77	41	5.9
Maximum:				270	235	72		1.0	21.0	2.5		67	79	41	6.0
Minimum:				223	213	72		0.8	5.0	0.8		66	74	40	5.8
Net Change:											17.5				

Feed Temperature: 70 deg F   Viscosity: 120 cP   pH: 7.47

Run Time: 45 min

* Water added to feed kettle

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/21/88	4	2	1005 <-- START				14.00				2531.0				
			1015	270	255	76	16.50	1.0	17.0	2.0		66	81	57	4.2
			1025	250	230	75	19.00	1.0	4.3	0.5		67	82	58	4.1
			1037	247	243	75	22.25	0.8	6.1	0.9		67	83	57	4.2
			1045	247	241	75	25.25	0.9	2.9	0.4		66	82	57	4.2
			1052 <--END								2550.0				
			Mean:	254	242	75		0.9	7.6	1.0			82	57	4.2
			Maximum:	270	255	76		1.0	17.0	2.0		67	83	58	4.2
			Minimum:	247	230	75		0.8	2.9	0.4		66	81	57	4.1
			Net Change:								19				

Feed Temperature: 69 deg F

Viscosity: 40 cP

pH: 8.12

Run Time: 47 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/22/88	4	3	1034 <-- START				13.00				2706.0				
			1044	241	226	65	15.00	0.8	17.5	2.4		65	71	42	5.7
			1054	260	245	66	17.00	0.8	15.1	2.1		66	78	41	5.8
			1104	255	240	66	20.00	1.1	5.8	0.6		66	79	41	5.8
			1114	245	232	66	22.25	0.7	0.0	0.0		66	79	41	5.8
			1124	239	230	67	27.00	0.9	15.8	2.0		66	80	41	5.8
			1129 <--END								2728.0				
Mean:				248	235	66		0.8	10.8	1.4		66	77	41	5.8
Maximum:				260	245	67		1.1	17.5	2.4		66	80	42	5.8
Minimum:				239	226	65		0.7	0.0	0.0		65	71	41	5.7
Net Change:											22				

Feed Temperature: 60 deg F Viscosity: 26 cP pH: 7.60

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/22/88	4	4	1550 <-- START				14.00				2823.0				
			1601	265	246	64	16.75	1.0	14.0	1.6		66	70	39	6.1
			1610	265	245	67	19.00	1.0	4.2	0.5		66	74	39	6.2
			1620	260	250	69	21.50	1.3	12.9	1.1		66	76	41	5.8
			1631	250	235	63	26.25	0.9	11.1	1.3		65	76	54	4.4
			1634 <--END								2833.0				
Mean:				260	244	66		1.1	10.6	1.1		66	74	43	5.6
Maximum:				265	250	69		1.3	14.0	1.6		66	76	54	6.2
Minimum:				250	235	63		0.9	4.2	0.5		65	70	39	4.4
Net Change:											10				

Feed Temperature: 61 deg F Viscosity: <25 cP pH: 7.69

Run Time: 44 min

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/27/88	4	5	1814	<-- START			12.75				3139.0				
			1824	255	225	65	15.00	0.9	15.1	1.9		64	69	30	7.9
			1834	255	230	65	17.00	0.8	12.8	1.9		65	74	30	8.0
			1848	240	200	65	20.00	0.8	10.9	1.6		65	77	31	7.7
			1854	212	200	65	22.00	1.0	6.5	0.8		65	74	32	7.5
			1904	232	220	65	26.50	0.9	6.5	0.8		65	74	31	7.7
			1908	<--END							3159.0				
Mean:				239	215	65		0.9	10.4	1.4		65	61	31	7.8
Maximum:				255	230	65		1.0	15.1	1.9		65	77	32	8.0
Minimum:				212	200	65		0.8	6.5	0.8		64	69	30	7.5
Net Change:											20				

Feed Temperature: 61 deg F   Viscosity: * cP   pH: 7.83

Run Time: 54 min

* Lost Data

PROCESS DATA

Date	Test	Pass	Time	Extractor #1 Pressure (psig)	Extractor #2 Pressure (psig)	Extractor #1 Temperature (deg F)	Depth to Feed (in.)	Feed Flow (gal/min)	Solvent Flow (lb/min)	Solvent/ Feed Ratio	Electric Power (kw-hr)	Cooling Water In (deg F)	Cooling Water Out (deg F)	Cooling Water Flow (sec/3.99 gal)	Cooling Water Flow (gal/min)
9/28/88	4	6	1203	<-- START			16.00				3229.0				
			1213	255	230	70	18.25	0.9	17.5	2.4		65	74	41	5.8
			1223	245	225	71	20.75	0.8	7.2	1.1		66	79	39	6.1
			1233	255	220	73	24.50	1.1	10.9	1.2		65	79	40	6.0
			1243	<--END							3245.0	65	80	40	6.0
Mean:				252	225	71		0.9	11.9	1.6		65	78	40	6.0
Maximum:				255	230	73		1.1	17.5	2.4		66	80	41	6.1
Minimum:				245	220	70		0.8	7.2	1.1		65	74	39	5.8
Net Change:											16				

Feed Temperature: 60 deg F

Viscosity: * cP

pH: 7.40

Run Time: 40 min